STAFF WORKSHOP

BEFORE THE

CALIFORNIA ENERGY RESOURCES CONSERVATION

AND DEVELOPMENT COMMISSION

In the Matter of:	)
	)
2005 BUILDING ENERGY EFFICIENCY	)
STANDARDS PROJECT SCOPE,	)
SCHEDULE AND PLANS	)
_____	)

CALIFORNIA ENERGY COMMISSION

1516 NINTH STREET

HEARING ROOM A

SACRAMENTO, CALIFORNIA

FRIDAY, NOVEMBER 16, 2001

10:02 A.M.

Reported by:
James A. Ramos
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COMMISSIONERS, ADVISORS PRESENT

Arthur Rosenfeld, Commissioner

STAFF PRESENT

William Pennington

Bryan Alcorn

Jon Leber

Mazi Shirakh

Ray Darby

ALSO PRESENT

Jim Benya

Charles Eley
Eley Associates

Mark Hydeman
Taylor Engineering

Noah Horowitz
David Goldstein
Natural Resources Defense Council

Robert E. Raymer
California Building Industry Association

Carlos Haiad
Gregg Ander
Southern California Edison Company

Lance DeLaura
The Gas Company, A Sempra Energy Company

A.Y. Ahmed
Occidental Analytical Group
Consultant to Southern California Gas Company

Ken Nittler
Enercomp, Inc.

ALSO PRESENT

Patrick Eilert
Pacific Gas and Electric Company

Douglas Mahone
Nehemiah Stone
Jon McHugh
Heschong Mahone Group

Michael Hodgson
ConSol Energy Consulting
representing California Building Industry Association

Bill Mattinson
Sol-Data Energy Consulting
California Association of Building Energy Consultants

Thomas L. Trimberger
California Building Officials

Dave Ware
Owens Corning
representing NAIMA

Michael S. Day
Beutler Heating & Air Conditioning

Steven D. Gates
James J. Hirsch & Associates

Hasheem Akbari
Lawrence Berkeley National Laboratory

Martyn Dodd
Gabel Dodd Energy

Clifford Federspiel
Federspiel Controls

Don Felts
Energy

Jerome Blomberg
Sunoptics Prismatic Skylights

Harold Jepsen
The Watt Stopper

ALSO PRESENT

Craig W. Hoellwarth
Green INQ
representing Geothermal Heat Pump Consortium

Carl Hiller
Applied Energy Technology

Karl Fisher
LK Fisher and Associates

I N D E X

I N D E X

P R O C E E D I N G S

10:02 a.m.

MR. LEBER: Welcome to the second day of the second set of workshops on 2003/2005 standards development project. I'm Jon Leber. To my right is Bill Pennington, the Project Manager on this project. And normally Bill would be doing this, but he may have to be drawn away to some other things during the day, so I got the honor of running the workshop.

To my left is Bryan Alcorn, who's the Contract Manager on the Commission's contract for this project. And then there are various subcontractors who you will probably be hearing from later.

The Commissioners' Offices representatives or the Commissioners may join us at some time later today. And if you see them come in, somebody poke me, so that I recognize that they're here.

The purpose of this workshop is to review and discuss the nonresidential standards changes ideas proposed to the Commission. Again, as in the meeting that we had yesterday, we have a pretty tight time schedule which requires people

to make their comments as brief as possible.

We're not planning on discussing each template at each presentation but we have a question-and-answer period at the end of each subject matter.

The change ideas or templates have been submitted to the Commission or developed by Commission Staff or their contractor. And the agenda is organized by topics.

Little housekeeping things. There's copies of items that are being discussed on the table out in the front. There's a sign-in sheet that's out on the table in the front entryway. If you could please attach a business card to that, that would make it much easier for us to identify you.

Also if you could provide a copy of your business card to the court reporter so that they can know how to get your name right when they do the transcript. When you speak please identify yourself so that the recorder can tell who it is that you are.

When we get to the questions and answers, it looks like we have a fairly small audience today, and so we should have some ability

to identify people. Please come up to the microphone if you're not sitting at a microphone at the table.

If there's not time to speak we'll be accepting written comments to be submitted to us by November 23rd. And we will consider those as we review the outcomes of these workshops.

The first person on our agenda here -- the first subject is T-bar ceiling. I believe Mr. Eley is doing the presentation on that or --

MR. ELEY: I'm going to defer to Jon McHugh, who did that research on that.

MR. McHUGH: My name's Jon McHugh with HMG and representing the CEC group.

The idea behind this -- are we ready for slides? The purpose of this idea is to actually go back a step in 1992. The standards actually had a prohibition against using insulation that was laid on top of t-bar ceilings as meeting the thermal insulation requirements for the roof/ ceiling. And we're proposing to bring this back again.

The difference this time is that there is an ongoing PIER research project that's looking at the effective R value of lay-in insulation,

laid directly on top of t-bar ceilings, or ceilings where the acoustic tiles can be easily removed.

We would propose that there be several exceptions, and we'll actually be defining that as part of the research so that, you know, a small office in a large warehouse or a small office that's in a industrial manufacturing facility that those small areas could be exempt.

And then also situations where you have a change of occupancy; you have a building that previously was not a conditioned space, we wouldn't require that, if it had a very large plenum, that then lay-in insulation would be allowed. And the actual details are -- in terms of, I have here, 15 feet. But it would be buildings where you actually had a very high ceiling, and you're actually having just a nine-foot office space or something like that that's being retrofitted into that space. It wouldn't require that.

So those are some of the details that will be under some further research before the final proposal.

Next slide, please. The motivation

behind this is that the t-bar ceilings, they currently, if you have recessed troughers in those ceilings, right off the bat you're typically looking at about 10 percent of that ceiling area definitely not being insulated because most of those troughers are not IC rated. And therefore, there's just 10 percent of that ceiling area is basically a hole that's got a metal trougher in there.

Also, over time. people, because, you know, one of the benefits of t-bar ceilings is that the acoustic tiles can be removed so that you can perform maintenance or retrofits on equipment that are up above those tiles because you still have access.

When people go up through those tiles the tendency is for that insulation to get knocked away so that there's actually even less insulation coverage across the ceiling plane.

And then finally the thermal barrier is not the air barrier. There's actually air infiltration across each one of those tiles, and that further reduces the effectiveness of the insulation.

And finally, by not allowing lay-in

insulation to be placed at the -- right on top of the ceilings, by moving that thermal barrier up to the roof deck the ducts are now in conditioned space, and so the losses from ducts, both the air leakage from ducts, as well as the conductive losses from ducts has a dramatically reduced impact on the thermal performance of the building.

So, given all those reasons, that's why we've made this recommendation. Thank you.

MR. LEBER: Thank you, Jon. The next subject is cool roofs. For PG&E, Doug.

MR. MAHONE: This presentation is going to be made by Pat Eilert.

MR. EILERT: Thank you. Pat Eilert from PG&E. So basically what PG&E is proposing is to include in the next round of standards a prescriptive requirement based on climates for cool roofs.

And again that would be climate zone specific that, of course, leads to tradeoffs within the performance approach with respect to credits and so forth.

We would also, in the overall envelope approach, probably do some work on heat gain calculations and so forth.

The calculations, of course, would then reference the Cool Roof Rating Council values going forward. There would be quite a bit of a time dependent valuation benefit in cooling dominated climates for this kind of an effort. And that's okay for now, we'll respond to questions later.

MR. LEBER: Thank you, Pat. Do we have someone here for Cardinal Glass?

MR. MATTINSON: Sure do. It's the last Cardinal slide. This is Bill Mattinson speaking for Cardinal Glass again today.

Cardinal had one issue that they put forth in a template and that is to support NFRC values for all fenestration products in the nonresidential standards.

Currently there's an exemption or an exception of section 116(a)(2) which allows site assembled vertical glazing in buildings under 100,000 square feet, or with 10,000 square feet or less of vertical glazing to use the default table. As I understand it that's an ASHRAE default table, which is far more extensive; and, in fact, way more generous than the standard CEC default table, which is used for all other nonresidential and

high rise residential occupancies.

Cardinal has long been active in NFRC and continues to believe that NFRC testing and rating procedures are the best way to insure that the correct products are put into buildings and that the energy savings that are designed and approved are actually enacted.

The argument for including that table in the last round, most recent round of standards was the probably, I'm guessing - Charles could tell me, the lack of NFRC approved products in this domain.

Our expectation is, or Cardinal's expectation is that by 2005 when these standards go in there will be many more products. We have begun to see a few commercial window product manufacturers going through the NFRC certification process.

And essentially just believe that to continue to use this table which has no labeling requirements at all, neither temporary or permanent, beyond 2005 would be a big mistake. There's very little solid means of assurance that the correct products are installed without the testing and labeling requirements of NFRC.

Thank you.

MR. LEBER: Thank you, Bill. Do we have questions or comments on this subject?

MR. JOHNSON: Jeff Johnson, New Buildings Institute. Just a note. I think the situation that's going on with the Cardinal Glass, that we build with preference to the Cardinal Glass recommendation is something that is being faced pretty much up and down the west coast and in the northeast.

Those are the few areas of the country where they're trying to enforce building standards that have an NFRC requirement. And to date it's been very difficult, if not impossible, to find manufacturers are actually complying with that requirement.

The City of Seattle has just taken some actions that have started to require this for all glass. I think one manufacturer is starting to rate their product. But this is a problem that's going to be faced in a number of other areas, including California.

And until we make this a requirement for all glass products we're not likely to see that product coming to the market as quickly as we'd

like, so I really think this is an important one, just as NFRC for manufactured fenestration products was about ten years ago.

MR. LEBER: Bill.

MR. PENNINGTON: Bill, you were saying why you thought the Commission had limitations on the NFRC procedures in the last round. And one of the considerations that you didn't say was that there's a fairly substantial cost that's kind of a fixed cost of getting the NFRC 100SB rating. And our conclusion was that that cost became perhaps not cost effective for relatively small buildings. And, in fact, was clearly cost effective only for large buildings.

And, you know, maybe the threshold that we set is not quite right, but there is that issue, as well.

MR. ELEY: If I could add one more reason, since you kind of pointed to me when you were making that presentation.

Another issue is when you look at the industry that provides site-built fenestration products there's one group, I'll call them storefront fabricators. They're different from the people that do curtain-walls on large

buildings.

They tend to stock standard glass products and they have a very quick turnaround. And for them to meet the standard would be fairly difficult, and certainly not cost effective.

So I think, at a minimum, we'd have to deal with that particular site-built application of the storefront, you know, 7/11 or something like that.

MR. MATTINSON: It seems to me in my explorations into what products those manufacturers have available is that many of them have products that would meet the standards.

As you know, the new nonresidential standards have pretty severe demands for both U factor and SHGC. And almost all those manufacturers that I looked at do have product that, were it rated, could be used for compliance and could be verified.

So the question is, is it really that expensive for them to get their product rated or not. Because they have the products.

And as Jeff said, as long as they aren't required to rate it, then we're not going to get them to do that. I think the more demand there is

for the ratings and labels, the cost of providing that will go way down. I believe it has on the residential side.

And maybe I'm not understanding Bill's point, but to say it may be cost effective for large buildings but not for smaller ones, well, the smallest buildings we currently regulate are residences. And it's been extremely successful there.

MR. ELEY: But those are manufactured --

MR. PENNINGTON: It's very different --

MR. MATTINSON: I grant they are manufactured.

MR. PENNINGTON: A very different situation.

MR. LEBER: Okay.

MR. NITTLER: One issue that Bill mentioned at the tail end I actually think is as critical. When you get fenestration product performance our standards allow two general ways.

You can use NFRC ratings, or you can use default tables. And then there's several types of default tables.

But one glaring flaw in the standard related to that 100,000 square foot or 10,000

square foot of glazing area exemption is that there's a whole range of products that aren't required to have labels the way the standard's written right now.

You got to have labels if the product's manufactured in a factory. You got to have labels or label certificate if it's over 100,000 square feet and has more than 10,000 square feet of glass. But then there's this chunk in the middle. Whether or not you want to argue; I personally believe the NFRC ratings are cost effective. I operate a business that does NFRC ratings, so I should disclose that.

But leaving that aside, the one real serious flaw is the labeling. There is no reason i can think of why we shouldn't have the same labeling requirement, no matter what the source of the number is, the reasons to have a label are the same on all building sizes.

So we need to correct that flaw, at least.

MR. MATTINSON: So are you saying, Ken, that even if they're using this generous default table there should be a label to verify that that product, I agree, you know, is a fall-back, that's

vastly better than having unlabeled products.

MR. LEBER: Other questions, a comment here? Nehemiah.

MR. STONE: Yeah, at the time we made that change for AB-970 we did, with NFRCs, have a fairly significant analysis of how many buildings would be built; what size they'd be built; what size they would be in California; and what the breakpoint was of what was cost effective. And balanced that against what NFRC could actually meet in terms of demand.

At the time we did that everybody agreed that, you know, three, four, five years down the line that should be revisited and there should be, you know, it should be extended to smaller buildings.

I think at this time maybe we don't, you know, we don't have enough experience with it to find out, I mean to know for sure whether it can be extended. And we ought to take a look at that.

But, certainly there is no innate, hard fence that says you can't take it to buildings smaller than this. It's simply, you know, the biggest issue was that that was going to be 300 buildings per year, was our estimate; and NFRC

said, well, that's pretty much the limit of what we're going to be able to do in the first year, first couple years.

Taking a look at when these standards, the round we're talking about, is going to be effective, it might be appropriate to lower that threshold. I don't know that it would be appropriate to lower it all the way down to, you know, the smallest buildings.

But we wanted to give NFRC the ability to grow into that task. And I think that we ought to keep that in mind.

MR. LEBER: Other comments?

MR. MATTINSON: Just one final comment. And that is really Cardinal's position on this, in that these are standards that are going to start to go in place in 2005 and will be there for at least three years, if not longer.

Projecting that far into the future, maintaining this sort of nebulous default is possibly not the right thing to do.

MR. ELEY: Maybe a compromise is just to reevaluate the 100,000 and 10,000 thresholds and maybe bring those down?

MR. MATTINSON: I think that makes a lot

of sense.

MR. ELEY: Okay.

MR. MATTINSON: Yeah. Thank you.

MR. LEBER: Any other comments? If not, we can move to --

MR. MATTINSON: Oh, one final thing. And let's not forget the idea of getting labels on all the products wherever the source came from.

Thank you.

MR. STONE: Actually, Jon, I do have one more. John Hogan put this on the table, and he's not here to push it forward, and I'm not going to advocate all of his positions.

But one thing that I would like to say is that I'd like to see added to this, to Cardinal's recommendation, visible light transmittance as a labeled requirement, too. Not just U factor and SHGC. It will help an awful lot in verifying that when we get to what the real benefits of daylighting are, to have some verifiable numbers of what the visible light transmittance is.

MR. LEBER: Other comments? We'll move to HVAC. I believe Mark Hydeman is making that presentation?

MR. MATTINSON: What about Owens Corning?

MR. ELEY: There's a couple more --

MR. LEBER: Pardon?

SPEAKER: Well, you spoke on that yesterday, Dave.

(Laughter.)

MR. LEBER: Oh, I'm sorry, I must apologize for, you know, -- you should have tooted your horn a little earlier before I went off to the questions period, you know. Dave, please.

MR. WARE: Dave Ware, Owens Corning, also representing NAIMA. I had some templates to present here.

The first one is to establish mandatory R factors for nonresidential buildings. Basically there are no mandatory measures that are required for nonresidential buildings. And the question is why.

I have asked a couple of people that have a history with the Commission and no one really understands that. Maybe Bill and Jon could bring that up, or can respond to that.

But actually what I'm proposing is that we establish mandatory measures, envelope

measures, at least for nonresidential buildings. It just seems to make some sense.

We do have several ways. One is develop mandatory features specifically to nonresidential buildings, or another alternative is to apply section 150(a), which applies to the residential buildings, directly to nonresidential buildings, as well; at least for wood frame structures, because we need, I believe, that -- well, those numbers, one, were certainly cost effective for residential buildings. And I believe that they will be cost effective for nonresidential buildings, as well.

Alternatively, we could establish at least a minimum mandatory ceiling R value. All nonresidential buildings have ceilings. But we do recognize that there are a number of wall differences in nonresidential buildings types.

So it does, I believe, make some sense to, at a minimum, establish a ceiling R value threshold for nonresidential buildings.

And in addition, I'm suggesting that we also revive section 118(d)(1) where it talks about insulation and a type of insulation that is installed in certain building types. And I'm

suggesting that we set a minimum R value in that section. Because that section applies, I think, more often when there is an alteration. But it specifically calls out nonresidential buildings when, indeed, something is going on and insulation is being installed. But there's no provision in there regarding the minimum R value that ought to be used.

So I'm suggesting that a minimum R-19 be established for mandatory measure for ceilings and nonresidential buildings, and then it's consistent in section 118(d).

We know that R-19 is cost effective in climate zones that's already established in the packages for nonresidential buildings. So there seems no reason why, at a minimum, R-19 cannot be or should not be established for that minimum mandatory level, again as a minimum, if there's not other features that are established, as well.

Next slide. I think I really probably don't need to go into this. We know that many of those measures that are in 151, 150 are, indeed, cost effective. We know there's a minimum R-19 established in the prescriptive requirements for nonresidential are also cost effective.

And I think we're losing a lot of energy or lost opportunity for not establishing some mandatory minimums for nonresidential structures, as well.

My next slide deals with the second template in this section. I'm suggesting that also we revise the entire prescriptive envelope requirement for nonresidential buildings, high rise residential and hotel/motel occupancies.

And what I am recommending is that we revise these prescriptive envelope requirements in tables 1H and 1I to be consistent with ASHRAE 90.1. 90.1 values have been shown to be cost effective; that went through a very extensive consensus process last year under AB-970.

That whole 90.1 update to the U values in windows was put forward because of the interpretation of what 970 really meant. We lost all the opportunity to deal with the envelope improvements, as well.

Earlier this year we did take a look at what those improvements would mean on statewide energy savings if 90.1 envelope criteria were put forward.

Next slide. And we prepared the general

savings that were developed or garnered under the 970 activity with the additional nonresidential savings that could accrue should envelope and ceiling improvements be made to be consistent with ASHRAE 90.1.

And as you can see, there is fairly significant gains to be made; certainly enormous gains on the gas side of the equation, because that was really not addressed under 970. And we all know that gas prices are fluctuating and also impact a lot of the global warming environmental aspects of our society.

So these were some of the preliminary numbers that we took a look at earlier this year regarding the savings, if indeed 90.1 were brought into the standards.

Again, next slide. 90.1 has been shown to be cost effective. It was a consensus process. And actually if the Commission felt that the time was right to even move forward with something better than that, the ASHRAE tier 2 criteria is also available to take a look at. And I think it's been noted by Bill just a moment ago these standards don't go into effect until 2005.

So there's enough lead time, I think, to

take a look at this; and, more importantly than that, it also establishes a good threshold for nonresidential buildings in the future. And I think that's what really needs to be considered here in this proposal.

MR. LEBER: Thank you, Dave. Am I correct that was all the items on this one, but we need to have questions and answers, if there are any, on this.

Gregg.

MR. ANDER: Gregg Ander, Edison. I saw you table giving energy deltas potentially. Could you give us kind of a "Readers Digest" version of what the differences may be -- current prescriptive packages and ASHRAE 90 -- or Charles, whoever's most familiar with that.

I mean, in other words, what to do in terms of how might it affect fenestration or the physical properties of fenestration materials? How does it interact with opaque materials, et cetera.

MR. WARE: I think Charles would probably be better addressing fenestration. My understanding is that last year's activity came real close to, or better than, some of the

fenestration values of 90.1.

Let me give you an example of some of the envelope values. The minimum allowed wall R value for all wall types, whether it be a concrete wall, wood wall, or metal wall, would be an R-13. Right now we allow an R-11.

For ceilings the minimum would be R-19, and quite frankly for most situations for most climate zones you would see an R-30 in ASHRAE 90.1 procedure.

Floors would be an R-19 under the ASHRAE for nearly all floor types.

So there's a vast improvement if that standard were adopted or incorporated into Title 24 procedure compared to what we currently have. And that's what some of our -- the table that I gave earlier showed the savings.

MR. LEBER: Charles.

MR. ELEY: With regard to fenestration we leap-frogged ASHRAE on AB-970. We used the same methodology that ASHRAE did, but applied California's criteria for economic performance. And that led us to requirements that are more stringent than ASHRAE.

With regard to the insulation levels, I

need to get some clarification. ASHRAE has four different classes of wall construction and there's a separate requirement for each class.

MR. WARE: Correct.

MR. ELEY: And there's, I believe, three different classes of roof or ceiling construction, and there's a different criteria for each class.

Are you recommending that we adopt those classes of construction? Because the numbers you cited were for the case where you have an attic and it's easy and cheap to blow insulation into it.

The insulation requirements in ASHRAE for some of the other construction types are not that stringent. For instance, metal buildings or the case where the insulation has to be a rigid foam, or some type of rigid material applied above the structural deck, the requirements are not as stringent.

For each class the criteria were developed to be cost effective for that level.

Now, my own review is that if -- you mentioned tier 2, which ASHRAE doesn't acknowledge to exist.

(Laughter.)

MR. ELEY: But what we could do is take the ASHRAE procedures and apply California's economic criteria. But to do that I think we would have to look at the classes of construction. So that's where I want to get some clarification.

Do you agree with the classes of construction that ASHRAE has?

MR. WARE: Well, I can't agree or disagree with the classes of construction. And they have classes of construction and that is -- yeah, it's way different than what we have here.

If you take a look at the classes of construction and you look at the minimum values that are there, like you said, for instance the biggest -- let's just pick on an example of rigid insulation on the roof deck. The minimum that would be required under all the heating and cooling degree day criterion, ASHRAE is really R-15.

But if you take then the other class of ceiling construction types delineated in ASHRAE for metal buildings and for attic situations, at a minimum it's R-19 or R-30.

So, as you said, under 970 for

fenestrations we leap-frog ASHRAE. So there's at least a precedent for being creative with the ASHRAE standards 90.1 value to accommodate California compliance.

And I think that -- and it's that essence is what I'm suggesting here. One, we do know that for most situations ASHRAE's based envelope values are greater than, for most, are greater than what the California requirements are.

So that the real challenge here is, at least looking at the savings table here, we believe that there's potentially great savings that could be gained by taking the time to see if, indeed, there's opportunity to consolidate some of those tables, if you will, into new values that represent California situations.

I'm not suggesting that we use the ASHRAE classes, okay. I think that we have enough --

MR. ELEY: Okay, you're not.

MR. WARE: -- process here; we ought to maintain that.

MR. LEBER: Nehemiah.

MR. STONE: Yeah, I just would like to urge a little caution in thinking that more

insulation is always better.

We've taken a look at a number of high rise buildings in temperate climates, and it turns out that there's enough hours on the shoulder where the buildings are really driven by internal gains. And the lower your R value for the envelope in those areas, the less energy you end up using.

So, when we have looked at, you know, for the multifamily program, for example, for high rise buildings, we've looked at the different measures that would help out, we tried increasing the R value of the walls and decreasing the U factor of the windows, and found out that actually things got worse because you can't conduct those internal gains off when you're in the spring and the fall days when it's more driven by internal gain.

So we need to do a close analysis to make sure that in all cases that we're going to propose, increasing the R value of the envelope that it really is beneficial.

MR. LEBER: Mr. Darby.

MR. DARBY: Ray Darby, California Energy Commission. I'd also add to what Nehemiah was

saying that we should also be careful to look at the impacts of other building construction attributes, such as cool roofs and thermal mass and ceiling decks. Because I've seen that also have considerable impact on the cost effectiveness of the ceiling insulation.

For example in the work done in support of 90.1 by Asheem Akbari, Bruce Wilcox and others, they found that in many of our California climates about 85 percent of the R value that's normally used in ceiling assembly with a dark roof can be used in the ceiling assembly with a light roof to achieve about the same annual net energy consumption, or same level of cost effectiveness.

In investigating our own roof here at the Energy Commission, which has a very thick cement deck, we also found that less insulation was cost effective in this case.

So I think that there are several issues associated with the mandatory minimum that are important for us to look at.

MR. LEBER: Thank you, Ray. Hasheem.

DR. AKBARI: If I wait enough other people will make my comments. I would like, first of all, to add that there are several measures

that are impacting the heat performance of the roof system.

These measures are cool roof, ceiling insulation and radiant barriers. If you want to also add to it ventilation of attic area, that would be a fourth one.

So, it would be perhaps a good time for the Commission to look at some unified criteria for optimizing this roof system for various buildings in various climate regions.

I think that the gentleman is aware, does have an excellent point. I would concur with Ray Darby's comments regarding our own observation and own analysis.

What I would definitely recommend for the Commission to do to look at this thing on a basis of the minimum life cycle cost, which includes the cost of the various energy efficiency components, as well as the heating and cooling energy savings associated with them.

I mean that, also, you would definitely like to include the real time pricing so that the impact of those components that are having significant energy savings during the peak electric hour would be reflected correctly.

I also would like to add these other two components, which is minimal. It has been our observation and also many other people observation that the R value of the insulation decreases over time.

So in our analysis we definitely would like to allow for a depreciation in the R value of the insulation so to require enough insulation at the beginning that when it is aged would reflect the R value that we would like to have.

Secondly, the R value of insulation is also temperature dependent variable. All of those insulation R values currently are being measured and coded at 70 degrees Fahrenheit. At a roof condition of say 130 or 140 degrees Fahrenheit that R value can decrease by as much as 30 percent. These are measured data. Clearly that should be another component in the life cycle analysis.

MR. LEBER: Thank you. Jeff.

MR. JOHNSON: Jeff Johnson. I just wanted to comment on the class of construction discussion. We've been doing a lot of work in trying to prepare code changes for the International Energy Conservation Code.

And in that process we've been looking at the format of the ASHRAE tables, as well as the classes of construction, to try and make them more usable, more understandable. And have prepared a revised format that was submitted yesterday for consideration by the International Code Council.

I'd be happy to provide that to the Commission. I think there's some value in looking at that particular format and how useful those tables are as you look at this issue. They'll also be -- to look at the usability issues and possibly consider that format for use.

We'll be submitting this to ASHRAE, as well, and working with the envelope committee on a possible revised table format.

MR. LEBER: Thank you, Jeff. David.

DR. GOLDSTEIN: David Goldstein, NRDC. I want to agree with what Jeff just said about the categories. I think ASHRAE unnecessarily proliferates categories and requirements and that can lead to complexity you don't need.

I do agree that we should redo the optimizations for California economic conditions and see what levels of insulation make sense.

We shouldn't do mandatory minimums for

the reason that Nehemiah pointed out, because they might not even save energy.

What we might want to do if it isn't too much work is to figure out why David and others think there's a need for mandatory minimums. In other words, if there's an R-19 prescriptive requirement, and a lot of people aren't putting in R-19, that might mean that they're in these internally dominated buildings in mild climates.

It also might mean that there's an enforcement problem. Or it might mean that there's a lot of energy on the table through some other tradeoff loophole, and rather than putting in the minimum we ought to see what is it that people are using for that loophole, and close that one off instead.

MR. LEBER: Thank you. Mazi.

MR. SHIRAKH: Mazi Shirakh, CEC. I've got a question for Hasheem. You said there's a degradation in performance of insulation. Is that true for all classes of insulation, and would it matter whether it's in the attic or the walls?

DR. AKBARI: The answer is absolutely yes on all of them. There are enough data to showing that the insulation, particularly for the

ceiling, would reduce by as much as 30 percent from what that it is being quoted initially.

Blown in, fiberglass and rigid.

MR. PENNINGTON: As a result of what?

DR. AKBARI: For the blowing and the fiberglass, it's mostly because of the compactness.

MR. PENNINGTON: It's a settling?

DR. AKBARI: Settling and moisture. So these are the two factors. For the rigid foam boards it's because of the exchange of the gases that are inside, and replacement of those gases with air, basically. And that does have the impact. Plus moisture.

MR. LEBER: Thank you. Martin Dodd, I believe. Come up to a microphone, please.

MR. DODD: Martyn Dodd, Gabel Dodd Energy. On the topic of mandatory measures, having the roof insulation as a mandatory measure is probably unnecessary. And the reason I say that is it's pretty much impossible to get a building to comply with no insulation.

So if we're trying to force people to put insulation into the roof, it's not an issue. People invariably do projects and they come in and

they say, well, we want to put no insulation in the roof. The only way to get the project to comply is to insulate it. That's self regulating.

The insulation levels that are in the standards, my office probably does 200, 300 jobs a year, and people invariably want to try increasing the insulation on those projects.

What we find is increasing above the prescriptive usually doesn't get any significant benefit. So the prescriptive numbers that are in there, they're pretty solid as far as that goes.

But what needs to be looked at, and this is one that everybody's overlooked, is the mass wall. Okay, the mass wall is a completely uninsulated issue in the standards. So if you're putting in like an 8-inch CMU wall, there's no insulation.

Now, if you put insulation on that wall suddenly you've got a building that does extremely well relative to Title 24.

I just worked on a project where they insulated the mass wall on the outside, and we ended up about 30 to 40 percent better than code. So that's something to look at.

MR. LEBER: Mr. Ware.

MR. WARE: Dave Ware, Owens Corning and NAIMA. Just like to respond to a couple of comments. Hasheem, there is an ASTM activity dealing with H R values, okay. And we are actively involved in that process.

And I agree with you that at some point in the future all of our references R value information using that procedure would be better served. But I think that we ought to wait until that procedure is completed, and manufacturers have tested, and there's good, you know, we have that data to use.

Dave Goldstein and others have mentioned, and Martyn just mentioned also, he thinks that in particular the ceiling insulation is somewhat self regulating. Our installers, not just Owens Corning's installers, but other company installers in California have continuously noted the number of tilt-up concrete and metal building industrial applications all, you know, offices, et cetera, with no insulation in the ceiling.

And obviously either it's an enforcement situation, or there are other things being traded around in the building.

Now, it's our belief, and I can attest

there are at least a half a dozen very large buildings here right in Sacramento with no ceiling insulation and all offices underneath that deck.

And something else is going on. There's a large internal load, et cetera, but that is, I think, an example of where there ought to be some consideration at least for the need to establish some criteria for a minimum ceiling insulation, if nothing else. Because something's going on that's driving the ability not to install ceiling insulation in that situation.

MR. LEBER: Okay, thank you. We need to move to the next item. If we have further discussion time at the end of the agenda today, we can come back to this.

Mr. Hydeman, HVAC.

MR. HYDEMAN: Thank you. I'm Mark Hydeman, Principal at Taylor Engineering. We're the lead on the nonresidential HVAC measures as part of the Eley Associates team for the California Energy Commission. A copy of these slides, according to Jon Leber, will be available on the CEC website, so I will skip some of these issues in the interest of time.

So, next slide, please. Okay, the first

item that we'll cover air side economizers. The proposal in our screening paper is to modify the prescriptive requirement that presently exists for air side economizers in section 144(e)(1).

There are two items to this. First is to look at the threshold system size for which air side economizers are required. And currently that's set at 7.5 tons in all climates. We're proposing something that would be more climate based, so that the threshold size might be different in a climate zone with Barstow in it than it would be for San Francisco.

There's also a requirement we're looking at for minimum damper leakage. And this would be both on the return and outside air dampers for air side economizers. It would be climate based, from 4 to 20 cfm per square foot of damper base at one inch water column. And that's based on AMCA standard 500 test, rating standard.

And both of these measures, in part, come from ASHRAE IS standard 90.1 2001 and the references are there.

Next slide, please. This is an example of the damper leakage table by climates. And the slide that follows this covers the climates in

California, the 16 climate zones and how they fall into it.

I'll just point up four items on this. The ultra low leak air foil dampers make the requirement for a 4 cfm per square foot; to make the threshold of 10 cfm per square foot you need something like low leak triple V groove dampers. And then a standard damper with blade seals would be able to make the 20 requirement.

Next slide, please. This just is a mapping of the air side economizer, heating degree day, cooling degree day, threshold for the previous slide with the 16 California climate zones, and it shows where each of those climate zones presently falls in that requirement.

Next slide. And I will come back to the leakage issue later, because it actually resides in a different section of the standard.

The hydronic system measures, we're looking at some new prescriptive requirement. The first is design for variable flow which includes a requirement very similar to what's presently on fans to have a means for modulating pumps such that you have 30 percent of the design kW and 50 percent flow for all pumps over 50 horsepower, and

100 feet of head. And we'll be looking at these thresholds.

This is based on the standard 90.1 requirement. But that would basically be requiring variable speed drives on pumping systems where those pumping systems are designed for variable flow.

There are exceptions that would cover minimum flow characteristics of equipment, such as the minimum flow required for either a chiller or a cooling tower to operate properly.

There's also requirements discussed in the paper for where the pressure sensor location is, so that it's not just right there at the discharge of the pump, and that you actually get the most turndown in the system that you can achieve.

The next item has to do with pump isolation, that you must have the ability to isolate the pumps such that if you have multiple chillers and pumps, for instance, let's say three chillers each with dedicated chill water and condenser water pumps, that you can stage one pump with one chiller, two pumps with two chillers and so on.

There's a requirement we're looking into for chilled and hot water reset controls. And that's particularly important on constant flow systems. There is some interaction on variable flow systems where you're trading off pump energy potentially against chiller energy. And those two are identified in the standard 90.1 requirement.

And also a requirement that came into standard 90.1 2001 to have isolation valves on those water cooled units that hang off of a condenser water system, such that that system would be designed for variable flow, that would include water loop heat pumps and miscellaneous water cooled air conditioners or computer room units that you would see typically as tented units off of a commercial building.

Next slide, please. Duct sealings, we're into the third paper here. There are actually two papers on duct sealing. One was presented by the Commission's consulting team, and another one was presented by the PG&E case initiatives. We are working together. And they will result in one study. I just wanted to mention at this time. There will only be a presentation here under the CEC team about the

duct sealing measures.

We're looking at new mandatory requirements based again on the ASHRAE 90.1 requirements. Again, the section is cited in the slide.

We're looking at minimum levels of duct sealing to be required. And that would follow the SMACNA tables. And so for different pressure classes of ducts, as you'll see in following slides, minimum levels of sealing would be required.

The ducts that operate currently under 90.1 at three inches water column and higher would be required to have leakage tests. We are going to do some life cycle cost analysis to determine whether or not it makes sense to drop that threshold from 3 inches to a lower number.

And those leakage tests would be performed, at minimum, on 25 percent of each section within a pressure class. So, one quarter of the ducts within a specific pressure class would have to be tested to meet this requirement.

And, again, I mention the case initiative collaboration.

Next slide, please. This table is the

duct sealing table. It's by pressure class, on the supply side, and separates supply, exhaust and return. And refers to, now this is directly out of 90.1, again we'll be looking at these break points -- on the left side you'll notice it says duct location. So more stringent requirements are in ducts located outside than in unconditioned spaces, or conditioned spaces.

A is the most stringent level of sealing; C is the least stringent. And it varies by the supply pressure, in the case of the supply ducts; or again, whether it's supply, exhaust or return.

Next slide. The duct sealing, this just tells you what is required for each of the levels. And, again, these slides will be available on the website, but it's pretty easy to do.

Next slide. In light commercial, this is part of the case initiative requirements, they're looking at taking something that was presently a performance credit under the AB-970 standard and bringing it into a prescriptive requirement.

And it requires duct testing and sealing, to know more, to prevent leakage, to 6

percent of design flow or less. It would probably be a HERS type of rater that would be doing this testing, as opposed to the large commercial, which would be done by test and balance contractors.

And the light commercial would apply to all air systems serving less than 5000 square foot of space with ducts in either unconditioned space or the outdoors.

Next slide. We're looking at -- this is a separate paper -- looking at the potential change for the performance method of compliance. And particularly to look at the system map.

This is the method by which the HVAC, the default HVAC system is selected for compliance for the budget building. And we'd like to review that system map and the design parameters using data that was collected in the development of 90.1's energy cost budget method.

And also the defaults that have been developed for eQUEST, VISUAL, DOE and other simulation tools. The defaults that are in Title 24 are some 10 years old, more or less, and there's certainly some known areas where subsequent analysis has determined there are better defaults.

Next slide. Chiller table modifications. We're looking at revisions to existing mandatory measures, section 112 in the standard.

The first revision is to update the reference standard from 550 and 590 1992 to ARI 555, 90 98. There's a couple very important things that must be done, some of which were overlooked in the ASHRAE upgrade to the new standards.

550 590 98 has a much lower fouling factor, and therefore chillers look more efficient when you rate them by that standard. We're planning to take that into account so that we have equal stringency when we change the tables.

And then when you go from IPLV to the new NPLV you have to look at the condenser relief curves that are used, because they've changed drastically, as well as the weighting factors at the 100 percent, 75 percent, 50 and so on and so forth.

We also want to simplify. There's three tables right now in Title 24 in the AB-970 standard and six tables in ASHRAE standard 90.1 2001. And we'd like to reduce those tables to a

single half-page table which has, instead of a whole range of rating conditions, just three or four points that cover high lift, low lift and something in the middle. Make it much easier for people to deal with.

So you would have alternate rating conditions for chillers, centrifugal chillers that could not operate stably at the ARI rating condition. And we are already working with ARI to develop a procedure to do this.

Next slide, please. Duct and pipe insulation. We're looking at modifying existing mandatory measures for pipe insulation. And to bring the duct insulation into Title 24 where we can, in this round, and future rounds, look at it from a life cycle cost basis. Presently it's in the California Mechanical Code.

We propose to redo the life cycle cost analysis for duct and pipe insulation levels. And, Dave, we would love to get NAIMA involved in this, so I'd like to exchange cards after the session. And we are also collaborating with case initiatives.

Next slide. Unitary single zone variable air volume systems. This is something

you hear, I believe, both from JJH Associates and Southern California Edison. We're proposing a new prescriptive measure and I would like to, as well, collaborate with you all on this.

To add, at minimum, two-speed motors, variable speed drives on supply fans to all package units with two compressors or more. This is something that Steve Gates brought up at the last presentation. It was considered in the early rounds of 90.1 in 1999.

Units that are presently 20 tons and under are covered by EPACT; and there's a possibility that there is a preemption there. One of the things we'll do is review that. And hoping we'll get some support from ARI, GAMA and Mike Martin from the Commission in that area.

And next slide. Thank you. Shut-off dampers. We're looking at modifying existing mandatory measure which is 122(f) required on supply and exhAust dampers. And as I mentioned earlier with economizers it would be required on the return damper, as well.

The dampers must meet the AMCA 500 leakage ratings, and again, if you go back to the economizer slides it's the same tables. And we

want to preserve some of the existing exceptions. And these are dealt with in our screening paper.

Next slide. Stair and shaft vents. We're proposing brand new mandatory measures based on stuff that was developed for 90.1 2001, and that would be automatic dampers required for stair and elevator shaft vents to reduce the infiltration.

Those dampers must be interlocked to the fire/smoke system so that we do not decrease the life safety of the buildings. And gravity dampers will be acceptable in buildings less than three stories, and in all buildings in mild climates with less than 2700 heating degree days 65.

And, again, my previous slide shows you what the heating degree days 65 are for the 16 California climate zones.

The ASHRAE IES standard 90.1 section on which this is based is referenced. And this requires some coordination between the Energy Commission, the California Building Code section 3004, and the State Fire Marshal.

Next slide. This next one deals with an existing prescriptive requirement, and that's the requirement essentially for variable speed drives

on -- or variable pitch vane axial fans for large fans. And presently I think it's set at 25 horsepower limit -- I'm sorry, I'm at the fan control, jumped ahead.

This one is to modify the pressure sensor locations similar to what I discussed on the hydronic systems. And to make sure that the pressure sensor is located such that its design setpoint is no greater than one-third the design static pressure for the fan.

So that can be accomplished either by moving the pressure sensor way out in the system, or doing reset by the VAV boxes. In addition, for those systems controlled by direct digital control systems, we're going to require that the set point be reset by the worst box, or the worst like 10 percent of the boxes, such that you're maintaining the minimum pressure to keep those boxes satisfied.

Next slide. This is a curve showing the effect on a sample fan of the setpoint, and how it impacts the energy use by that fan. The top curve is where the setpoint is the design setpoint of the fan. And the bottom curve, which is purple in this graphic, is where the setpoint essentially is

perfectly reset by the boxes.

Next slide. The size threshold for VAV fans we're also looking at modifying. Currently it's set at 25 horsepower. We believe that through life cycle cost analysis, given the way that the variable speed drive prices have dropped over the last ten years or so, that we could probably drop that threshold. And that's worth looking at.

Final slide, please. We're also looking at revising the zone isolation control requirement. Take a look at some of the stuff again that was from the ASHRAE IEC standard 90.1 2001.

We'd like to add a requirement for central plant unloading that's in 90.1 that's a complement to the existing zone isolation requirement. If you can't turn down your plant, you're missing some of the benefits from having the zone isolation dampers. And the 90.1 language in that area is much more explicit than the current version of Title 24.

And there's also an exception for spaces intended to be inoperative only when all other spaces are inoperative. For example, airport

terminals or bus stations where they may be more than 25,000 square feet, but they all come up and down as a unit. And therefore the additional cost for zone isolation dampers or controls is not justified.

And that concludes my formal presentation. We can open it to questions if that's okay with Jon.

MR. LEBER: Thank you, Mark. The questions will be when we get to the end, and hopefully I don't forget anybody this time.

Mr. Johnson, I believe, is for performance verification.

MR. JOHNSON: Yes. Jeff Johnson. I'm going to be talking about something that's being called performance verification. We're still in the process of a name-the-baby on this. Probably a better term for this can be something like acceptance requirements for code compliance, because I think that's what we're really talking about.

This particular set of requirements has got a couple components. One is to require some minimum documentation at the time a permit is requested. That minimum documents will aid in

ultimately accepting the testing of particular pieces of equipment to make sure they're performing according to the code requirements and/or design intent, as documented on the plans.

There's an inspection portion that actually will require physical inspection of this equipment. And, in fact, physical inspection of elements that contribute to that equipment's operation, as well as test requirements that will make sure that those pieces of equipment are actually working properly once they're installed.

There's another element of the proposal that has to do with who does this inspection. I think one of the challenges that we've seen is working with local building departments and trying to deal with more and more complex building systems. And so this proposal would require that third parties actually do the testing and certify the rigorous of the equipment.

I think Mark's presentation is a great segue to this, because I think the realm that we're getting into in terms of new code requirements for mechanical equipment, and I'd say even some of the existing requirements, is that things are getting complex and more complex.

And with the exception of a few designers that may be in this room, unfortunately the building construction community has been incapable of delivering performance systems.

An example, a study of 60 buildings up in Oregon, newly constructed buildings, half of them had control problems; 40 percent of them HVAC problems. They weren't operating properly; 33 percent had sensors that weren't operating properly, weren't calibrated or just were not functioning; 15 percent were missing specified equipment, equipment just flat out wasn't there; and about 25 percent had building automation systems or other efficiency measures that just weren't working properly.

I think the mantra is controls, controls, controls, and they're just not working right right now. So we've got to figure out how to make those things work properly.

So, in this particular proposal we're going to be looking at specific systems and equipment, and those will include ducts. We'll be coordinating with the proposals being presented on duct leakage. And identifying not only test requirements but procedures for doing those

testings, and who can perform those tests.

Lighting controls, economizers, variable air volume systems, particularly at the system level where we need to make sure that VAV systems, the outdoor air is tracking with the VAV system operation. Steve pointed this out years ago in the drafting of the original nonres manual, and it's still not happening.

Chilled water systems; and then ultimately building automation systems, and looking for how to verify some of the control routines as well as possibly using them as a means of verifying the performance of some of these systems through trend logging and other such applications.

This particular project does not have a formal proposal on the table because it's currently being developed. The current status is that we're in the process of developing test requirements. We'll be having draft test requirements and also draft documentation requirements sometime in the middle of December. And they'll help us define what scope of effort's going to be required to do this acceptance testing, what level of effort is required. Who

are some of the qualified entities that could possibly do this; as well as what's the regulatory basis for the particular requirements, because it will vary by measure by what we're doing.

Some of the next steps in the project are to have a workshop to discuss these test requirements. We're going to be working on pilot projects that will be implementing these test requirements.

I might note that these requirements are being implemented in a very wide scale through the commissioning efforts these days. And what we're doing essentially is assembling and configuring pieces of those efforts in a different way. So it's not new stuff; it's stuff that's being done, it's being just reconfigured for the code.

We'll be identifying third parties and what the requirements are. And finally, developing the justification in standards proposals which we expect to be sometime in the mid February timeframe.

So, that's it, thanks.

MR. LEBER: Thank you, Jeff. The next item is PG&E, Doug.

MR. MAHONE: For the PG&E mechanical

system stuff I'm going to pass it over to Mr. Hydeman.

MR. HYDEMAN: Then I will change my hats. Do you have the slides? Good. Next slide, please.

Now I'm talking about the PG&E case initiatives. There are four elements to this that we'll discuss briefly.

The cooling tower proposal originally was to look at more stringent cooling tower efficiency, that's GPM for horsepower, 95, 85, 75. And in addition, to look at the sizing of the tower by climates, which would look at the required approach temperatures, gets to the box size.

Those two elements at present it appears PG&E does not have the ability to fund those studies, so we are going to probably be dropping them. But there's potential there down the road.

We are going to look at the limitation for the application of centrifugal fans on cooling towers. And to require reset capabilities on cooling tower fan controls by load, by wet bulb or other means. I think that ties into an issue that Steve Gates will be bringing up later.

One measure that has come up in some of the PG&E work we've been doing on chill water plants is that it is really critical to design towers for flow turn down so that you can run the most tower cells possible. It uses the less fan energy. And that one is likely to be immediately cost effective, because when you design the towers for blow down it's cheaper than paying for the isolating valves required otherwise.

And finally, a very large issue and important one, is looking at the limitation on air cooled chillers by comparing the cost effectiveness of water cooled plants and air cooled plants, specifically on chilled water systems.

Next slide. This is to build on the Commission's work in AB-970 on demand control ventilation. We are proposing to expand the scope of that which is presently set at about 10 square foot per person to include the UVC occupancies, assembly areas, less concentrated use, and potentially classrooms. But to look at where the life cycle cost effective breakpoint is.

We're also looking at refining the outside air limit, the amount of outside air that

triggers this requirement for demand control ventilation which is currently set at 3000 cfm.

And presently there is a loophole for multiple units serving a single space example is two units at 1500 cfm outside air would not be required to have demand control ventilation when, in fact, the controls are very easy to implement off of a single sensor to reset both units.

And finally to fix the setpoint requirements or confusion about them for CO2 sensors that exist in the AB-970 standards. And that work is being done with industry cooperation.

The next one, and we touched on this earlier, and that's ducts in light commercial. So I'm going to go ahead and skip over that.

Finally get to the HVAC equipment efficiencies. We're looking at the equipment that is not covered by either NAECA or EPACT under Title 24 for which there are existing cost curves that were developed by the industry during the development of ASHRAE standard 90.1. And the idea is to take those existing cost curves and new market costs for the equipment to develop a life cycle cost analysis and determine if we can, in fact, increase the stringency of the standard on

COP, EERs, IPLVs and the like.

And that does it.

MR. LEBER: Thank you very much, Mark.

MR. HYDEMAN: Do I get my extra time from both sessions for the next workshop?

MR. LEBER: I don't think it quite works that way.

(Laughter.)

MR. LEBER: You can ask more questions at the end.

Mr. Ware, Owens Corning.

MR. WARE: Dave Ware, Owens Corning, also representing NAIMA.

I'm going to cover -- I'll try to do it briefly here. We support Mark Hydeman's suggestion for modifying the revising section 124 of the duct R value tables, and bringing the duct R value requirements directly into the California Energy Commission's requirements. And removing all of the references to the California Mechanical Code.

We're also suggesting that duct R values should be R-8. We did some preliminary analysis on commercial buildings earlier this year and we compared the results of just ducts of that R-8

duct improvement on commercial buildings compared to what was the savings in AB-970 activity.

Next slide. There's pretty sizeable savings just for the improvement of duct thermal conductance compared to the savings that were generated as last year's activity under 970. And we really think that that is worthwhile to take a look at. And that's the left table.

The table on the right is a preliminary table that I developed. It's fairly consistent with other states and things like that. It's very simple to implement and calls out the duct R value based upon the conditioned space, the conditions for which supply and return air is being delivered. And et cetera. So that's a suggestion how that table might work.

Next slide. Lastly there's, I think, a performance verification. There's a number of station jurisdictions that have adopted R-8, anywhere from R-6 to R-8. California's one of the outlier states that is behind the curve these days in the way of duct R values. So we support all the work that is -- we hope will be going into improving the duct R values.

MR. LEBER: Thank you, Dave. I assume,

Steve Gates, you're speaking for Hirsch.

MR. GATES: Yes, Steve Gates with Hirsch and Associates. While the slides are coming up I'll start talking.

A lot of what I'm talking about now has significant overlap with what Mark has been talking about with the Eley projects.

The first one has to do with variable speed drives on fans. Mark indicated that the current standards address fans above 25 horsepower. We strongly recommend that they do investigate lowering those limits to VAV fans smaller than that.

The concept that Mark identified about duct static pressure reset control based on VAV damper positions is also excellent. I would caution with that one that whatever control sequences are identified that there be a mechanism embedded in the controls to automatically identify rogue VAV boxes that may not be able to respond.

For example, I was involved in a project once where I did that for an entire building. The client then wound up sticking a very large copy machine in a very small room that was never intended to have such a copy machine in there.

The VAV box serving that zone absolutely could not satisfy the temperature requirements and that was sufficient to break the entire reset strategy. Whereas if the controls had been set up to be able to identify, you know, if a given zone is almost always being the extreme zone that's causing the reset, then that can be a way during the building commissioning or afterwards, at any given time, of identifying a problem that's popped up. Otherwise the whole control sequence can break down.

I'd also like to add that Southern California Edison currently has a project in DOE2 to improve the fan energy calculation algorithms. They'll become similar to the existing new pump algorithms in 2.2 where the program will be able to address the individual components in a VAV system and identify where the static pressures are arising, whether it's VAV boxes, duct works, filters, coils, that type of thing, you know; allow you to specify what setpoints are, reset setpoints based on VAV damper position.

So when this project is complete I think it will be a very useful tool for the work that Mark is talking about.

Next slide, please. Mark also talked about variable speed drive pumping systems. And identified some tentative thresholds for requiring variable speed drives on pumps.

I definitely agree that the standards are lacking in that respect. I'm hopeful that the thresholds that the Eley project identifies are lower than the ones proposed. My experience is that, you know, pumps less than 50 horsepower can be controlled cost effectively using a variable speed drive.

Again, Southern California Edison has a project in DOE2 where we are improving the ability of the chiller algorithms to work with variable speed pumping both on the chilled water side as well as on the condenser water side. And preliminary results that I've run on that do indicate that there are potential savings on condenser water pumping as well as on chilled water pumping. So that tool should also be available for use in the currently funded projects.

Next topic is chiller control with variable speed drives. Most of the major manufacturers now offer variable speed drives as

an option in their chillers.

The manufacturers data indicates that the chiller savings can be quite impressive on part load, provided that you do have condenser temperature relief, so that the condenser temperatures are allowed to drop as loads and wet bulbs drop.

There is a concern with this, though, that some studies have indicated that if you don't do the condenser temperature relief intelligently that you can burn up so much additional horsepower in the cooling towers trying to drive the condenser water temperature down below the wet bulb, which, of course, is impossible, that you can either reduce or offset the chiller savings.

So this particular concept also ties into the next slide that I have, which is condenser temperature relief. Again, Southern California Edison has a project where we are modifying the chiller algorithms in the program to be able to look at centrifugal chillers with and without condenser temperature relief so that this will also be a tool available for the ongoing work.

Next slide, please. One final area,

just to comment briefly on that, is not currently addressed by the standards at all, and that has to do with domestic booster pump systems in buildings.

Most buildings three stories and higher require booster pumps. When you -- typical municipal water supplies that are pumped, deliver water at the street at around 40 psi or so. By the time you run that through the back-flow preventers and the water meters, you've got five or ten pounds less than that.

When you look at flush toilets on upper floors requiring 15 psi to operate correctly, what you find is once you're up at three stories you're very marginal, and once you're at four stories it's almost a certainty that you're going to have booster pumps on the domestic water.

Manufacturers offer booster pumps in packages where you have typically two, sometimes more than two pumps, depending on the size of the building and the loads. Depending on how those pumps are controlled, the different sizes of pumps that are part of the package so that you can intelligently select small pump to run most of the time, and the larger pumps only during times of

peak demand, there can be some significant deviation in the overall energy consumed in booster pumping systems.

So, if anybody just happens to have extra funds and is interested in studying this concept, I would urge the Commission to consider it.

And thank you very much.

MR. LEBER: Thank you, Steve. SCE, is that Gregg Ander?

MR. ANDER: The staged volume control and VAV review will be presented by Carlos Haiad.

MR. HAIAD: Carlos Haiad, Southern California Edison. The staged volume control is something that the CEC has mentioned, as well. The basic idea is add a variable speed drive to the fan on single zone package unit.

The upshot of all this is that we are actually trying to implement this in a building. We are trying to do a field demonstration and the expectation is hopefully prior to the 2002 year end we'll have, I'm sure, field experience with it. As well as implementing whatever is needed so we can model that later on using DOE2 in this particular case.

There is opportunities for savings, somewhat a given. I want to stress that it's not a replacement for variable air volume systems. You couldn't accomplish the same comforts. But in building such a video place, Hollywood Video or Blockbuster Video, that you have very high and low occupancies, you could, you know, modulate your fan; you could gain tremendous savings. That's all for this project.

Let's go to the next one. This is a VAV with a -- all the analysis done in the past had the obvious assumption that, you know, you have electricity, you won't compete with gas. The bottomline is there is tremendous losses that earlier versions of the two views couldn't quite capture.

And what we are proposing here is to revisit that and see if, indeed, the losses are significant and we can, in fact, in a prescriptive mode allow, under certain circumstances, electrical reheat. And, again, we are investigating this; this work is on its way. So hopefully we will have results that could be used.

That's all I have, thank you.

MR. LEBER: Thank you, Carlos. Mr.

Federspiel.

MR. ELEY: There's another Edison for this one, too.

SPEAKER: There's EER and SEER ratings that are pretty well going to cover that?

MR. PENNINGTON: Yeah, that was discussed yesterday.

(Off-the-record discussion.)

DR. FEDERSPIEL: I'm Cliff Federspiel, representing my company, Federspiel Controls, which markets air flow measurement and control technology.

My proposed measure is direct measurement of outdoor air flow, by which I mean inserting a device into the HVAC equipment that would give a direct reading of the amount of outside air entering the mechanical equipment.

The benefits from doing this are reduced consumption on peak and improved indoor air quality simultaneously. And as evidence of that I show you this graph here, which is a curve fit to data from the National Academy of Sciences handbook on asthma and indoor air quality.

The smooth curve, the distribution that you see there is along normal distribution to the

data from that handbook. The underlying data come from three surveys that include almost 100 buildings. One of the three surveys was a survey of California buildings that was funded by the Commission and published in 1995.

There are two key features that this graph shows. The first is that on average buildings are ventilated at a rate that is 40 percent or so higher than minimum requirements. And that offers an opportunity for reducing consumption on peak.

And so what I estimate here is that that would be about .15 watts per square feet at temperatures that you might typically see on a hot day in central California.

The other feature that's important is that there's a lot of variability in this distribution. You can see that there are clearly a lot of buildings that are getting less than half of what is required; other buildings that are getting three times what is required.

By using direct measurement of outdoor air flow I submit that we could squash this distribution down and move it over to the left a little bit. By fixing up the buildings that are

on the left-hand side we would improve the air quality in those buildings. And there's a lot of research that's been done to show that low ventilation rates in that range, below Title 24, have health and productivity outcomes that are negative.

On the right-hand side we would get more than -- we would more than offset the energy impacts of what happens on the left-hand side of the graph, and end up fixing up those and saving energy.

The variability has some relevance to why this is something appropriate for Title 24. An equipment manufacturer can't go to a specific building owner and say I can save you 40 percent, because there's so much variability. And he doesn't know where their building lies in this distribution.

What's necessary is to apply this technology to a large population of buildings so the details of the distribution can be moved back towards the center, towards something that is reasonable.

And I think that's all that I have on it right now. Thank you.

MR. LEBER: Thanks, Clifford. That brings us to questions and answers, I believe. Actually, it's questions and comments. We don't give answers.

(Laughter.)

MR. MAHONE: Doug Mahone from HMG. I've got a question, sort of about the whole range of mechanical system requirements, but I'll cast it in terms of control sequence requirements under the energy code.

I've done a lot of training of building officials on both Title 24 and ASHRAE 90.1 requirements. And when I get into the mechanical system control details the first thing I observe, and actually I saw it here in this room, is that there's about 5 to 10 percent of the audience have any clue what I'm even talking about. And the rest of them just kind of sit there wondering why we're spending all this time talking about this stuff.

And when I ask them about it they say, well, there's no was that I, as an enforcement official, am going to come in and tell a licensed mechanical engineer how to set up the details of their control system. And even if I asked them

how to do it, there's no way I could verify that they actually did it.

And so I guess the basic question is are we actually accomplishing anything by putting all these very arcane and complex and unenforceable control requirements into Title 24.

MR. LEBER: Let's see, I think Don Felts had his hand up a little earlier.

MR. FELTS: I'm Don Felts; I'm on the Eley team. I'm also on Jeff Johnson's performance verification team.

One comment that I had about duct insulation and I didn't hear mentioned exposed rooftop mounted duct work.

Case studies I've done for PG&E in 2000, as well as commissioning work, indicates that we should be applying cool roof technologies to expose the duct work, and that should be integrated in the building code.

MR. LEBER: Thank you. We had a bunch of people who wanted to respond to Doug, I think.

(Laughter.)

MR. LEBER: I guess we'll start with Mark.

MR. HYDEMAN: If I may, just briefly.

Doug, I agree that there are many parts of the code that are very hard to enforce. But I don't think that those parts are without value. Particularly looking at the response of VOMA members to the crisis this summer.

Some things that weren't very easy for people to understand in terms of control requirements or wiring, for instance, bi-level switching or thermostat dead bands, you know, or adjustability, came to save the day.

And if you look at the papers that VOMA strategic groups came out with they were using the bi-level switching, and they were using the thermostat set points. Part of that is just getting the design community aware of capabilities that can save energy. And that awareness, if they put it into their designs, simple specifications, will later create the flexibility that allows those that follow behind them to do the good work.

So I wouldn't throw it out just because it's non enforceable.

MR. LEBER: Steve.

MR. GATES: Yes, following up on the same idea. First, I agree that controls are one

of the least understood aspects of building energy consumption. Controls are also one of the most critical aspects of building energy consumption. And it's difficult; and it's arcane.

One possibility that might help this work go forward is to recognize that many of the manufacturers of direct digital control systems have their control sequences set up as almost like cans, they'll call them control blocks.

Or concepts like that where basically you've got a lot of complex code where you simply take this module that's already predefined and hook up your temperature sensors, hook up your outputs to variable speed drives, or whatever. And it's already canned.

And recognizing that buildings that have built-up central plants with chillers and pumps, that type of thing, almost invariably have direct digital control systems at this point.

What it suggests is that rather than rely upon mechanical engineers to specify the control sequences, and then rely upon the controls contractor to program those into the DDC, a far more powerful approach might be to work directly with the controls, the DDC controls manufacturers

in terms of getting canned control sequences developed that are quite applicable.

And the reality is, and I think Mark will probably reiterate this, once you've looked at certain questions, for example Mark indicated that there were tradeoffs between temperature reset on a system, whether it's a fan system or a chilled water system, when you have variable speed drives you have these tradeoffs between, jeez, do you reset temperature first, or do you reset -- do you try to reset flows and get the horsepower from the motive force first, and then do the rest on top of that.

And all of the studies I've ever done on it, I've always indicated that you first reset flows, get the horsepower knocked down on the fan or pump first, and once you've gotten that knocked down to a reasonable level, then you do the temperature reset.

So, if that holds in terms of more buildings than I've looked at, then it does suggest that, jeez, there's really no reason why these types of sequences can't be canned, and just -- and that may be what the standards really need to look at, in terms of how do you get

something canned at the level of the manufacturers.

Because, clearly there have been so many conversations already about you set up a building and the thing doesn't work, you know, it's not commissioned right. It wasn't installed right by the contractor.

But I would guess that probably the equipment that works the best of any equipment in terms of right out of the box, is the stuff that's packaged. You know, packaged gas pack; you stick it on the roof; you stick a thermostat down the space and it works.

And the reason is because you had the experts at the manufacturer who put the whole thing together. You know they thought through all the problems, they thought through the sequences; and it works.

And so I think it can make a lot of sense to extend that same logic to larger systems.

MR. LEBER: Had another comment over here.

MR. JOHNSON: Just one of sort of a general requirement. You've heard about a lot of new mechanical HVAC requirements here. And I

think what we're concerned in this case, what Doug had said, is that we really need to have some performance based acceptance requirements, or just essentially making the code unnecessarily complex without really improving the performance of buildings.

I mean, those things really have to go hand in hand. I'd really urge the folks that are bringing up these requirements to get to the table that we're trying to create, through the work we're doing, the California Energy Commission contract on acceptance requirements for co-compliance, and think about how to solve these problems.

Steve's brought up one potential solution, which is essentially canned control sequences that maybe meet these acceptance criteria tests. And also demonstrate, you know, the requirements that Mark, for example, is calling out in the code.

So those are -- I think we need to think about working together to try and create this system that delivers these things, working, rather than just adding new requirements that the designers are going to specify, value engineer is

going to rip off, code officials can't certify, and buildings may or may not even have installed, and it may not be performing properly.

And so I really urge us to try and focus on it as sort of a systematic problem rather than individual pieces one at a time.

MR. LEBER: Bill, and then Michael Day.

MR. PENNINGTON: I have a comment that's very similar to Jeff's. I think that there's very good merit in what Doug was saying. And I think there's merit in the comments that were replied to him.

But I think from a standards implementation process we need to choose a path here. We need to either choose to eliminate these control requirements, or we need to choose a path that gets them verified in the field.

And maybe the verification can take a number of different alternatives; maybe fault detection equipment in the future is a thing to look at.

But I think we're sort of at a crossroads here that my opinion is that a blended strategy that has what I call performance verification, maybe that's not the best term in

the world, but a way to do a verification that these systems are functioning the way that they were designed to function that doesn't rely on the building official to deliver that, is required; or we need to back off on these control requirements.

MR. LEBER: Michael.

MR. DAY: Michael Day with Beutler Industries. We've seen a lot of discussion today regarding outside air and ventilation rates. And for a lot of people that do design work in the central valley and in a lot of our climate zones outside air is a very large part of the total design budget. It's a lot of Btus a year.

One thing that we haven't seen used in the code or in any of the modeling software is the ability to input precooling strategies for outside air. There are many products now that are available that allow precooling or pretreatment of outside air, and if we're taking a hard look at outside air it would be a very good idea, we think, to take a look at some of the precooling strategies.

You end up using fewer resources. You end up using less energy. And there are a lot of them that can do a lot of good. And not every

designer out there is just into plugging bigger Lego Blocks on top of the building.

So, for those of us that are trying to prove that to our customers the ability for the benefits of that to be modeled in the code would be good for everybody.

Thank you.

MR. LEBER: Thank you. Mark.

MR. HYDEMAN: Yeah, I just wanted to follow on to something Steve said. I want to make sure that the issue is caught, because it's one of the things I overlooked in my discussion.

A huge benefit of having the requirements in the standard is that manufacturers who presently have products that are canned, that don't have those capabilities, will eventually change those products. And the example I'll give is the Trane tracer system that used to have a dc temperature sensor on the wall. It had a fixed, I think it was a 1 or a 2 degree differential. So you could set the cooling setpoint or the heating setpoint and the other one defaulted.

And they had that all the way through until 1998, even though it was against the standard. Eventually someone pointed it out to

Trane, and they changed the product.

And by the fact that they changed the product, all of their customers were able to separate those set points and realize those energy savings.

So, there is a benefit, even without performance verification, if we can get the manufacturers to come in line with those requirements. I just would not throw out the baby with the bathwater.

MR. LEBER: Steve. Then Dave.

MR. GATES: Yeah, I actually had a question from the gentleman from Beutler who just spoke.

MR. DAY: Yes.

MR. GATES: Are you talking about, for example, indirect/direct evaporative cooling?

MR. DAY: Indirect, well, specifically I can think of three technologies. First off is indirect only evaporative precool where the heat exchanger is in the air flow, and the moist air stream is directed away from the outside air intake.

They take up about 60 percent in real life. They're rated at 65 percent of the

differential between the outside dry bulb and the outside wet bulb. In Sacramento that's pretty substantial.

MR. GATES: Yeah, what I was going to say is actually DOE2 does have the capability of both direct/indirect and indirect/direct preconditioning. So, if there are other technologies on top of that I'd be interested in hearing about them possibly after this.

MR. DAY: Sure. Another one would be simple geothermal loop used as a precooler. It's a little bit expensive up front, but it uses a lot less energy and a lot less resources over time.

And then also the dual cooled technology of Davis Energy Group, which precools the air entering the condensing unit section. And then allows that basically at wet bulb temperature water to utilized for precooling the outside air stream without adding any -- of moisture.

So there's a lot of stuff out there that could be used. But right now we basically do not have the ability to add the benefits of that into our analysis of any commercial structure.

MR. LEBER: Okay, David.

DR. GOLDSTEIN: Yeah, this is something

that may or may not work with respect to Title 24, but when I was trying to coordinate submission of comments to ASHRAE 90.1 on tier 2, and we were trying to come up with a tier 2 for HVAC, one of the suggestions that we had and weren't quite able to follow up on, but maybe it works here.

If you look at the effective EER of a built-up system you're going to get surprisingly low numbers a lot of times, 8s, 10s. And the reason for that is lots of losses from moving air around.

All of the existing standards, as I recall, are designed based on a pressure drop for the air distribution system, which is a worst reasonable case. And that provides a whole lot of fact for reasonable reasonable cases.

Maybe we're at a point where the performance path is well enough developed that we can design the watts per CFM around reasonable pressure drops, and figure that people who have unreasonable ones just have to make it up somehow in the performance calculation.

MR. LEBER: Don Felts.

MR. FELTS: In talking about the indirect evaporative cooling I want to note that

PG&E did quite a bit of work on this a couple of years ago, and what we found is that -- and I don't work for PG&E now, but I used to -- but we found that indirect evaporative cooling works really well in buildings with high ventilation load, such as assembly occupancies.

But other buildings, such as office buildings, it didn't. It was not cost justifiable. And also at assembly occupancies with that high ventilation load you use the exhaust air stream, which has been conditioned and dehumidified by the air handling unit, and it's a real perfect source for indirect vacuum cooling. You're going to end up by dropping chilled water plant size by as much as 20 to 30 percent using that technology. It's very worthwhile in looking into that.

MR. LEBER: Other questions? Jeff.

MR. JOHNSON: Yeah, just a series of sort of specific comments on the different proposals I'd like to run through. Won't be exhaustive, just to make some notes.

I guess first of all the damper proposal that is being proposed by the Commission, those levels of 4, 10 and 20 cfm per -- at one-inch

water column, essentially refer to class 1s, 2 and 3 in the AMCA 500 test.

And, in fact, those are values that are more consistently used in fire code applications. And mostly references class 2. They pretty much don't reference anything else, but I'd say that you're on track using those values.

In terms of the isolation valve requirement we're actually looking at a proposal by PNNL, actually DOE, to add that to the IECC. And we're very concerned that in its current written format it's unenforceable. It's a very vague requirement even though I think what you're trying to get at is a very, you know, really good way to reduce parasitic losses in cooling towers.

So we need to think about how to maybe craft that requirement to be a little more enforceable.

On the duct proposal I encourage you to not define light commercial by size. I've been involved in 200,000 and 300,000 square foot buildings that have, quote, light commercial systems on them. Fields of package equipment that can have great, you know, high duct loss. So I'd really think about how to reclassify that.

On the other ducts we've been working with -- have contacted Eastern Washington University and a number of others who do test large duct systems. They use standard duct blaster testing. It's a pretty common thing.

They're also finding that 1 percent leakage is very attainable and that on the lighter commercial smaller systems the 6, 7 percent range is a better target.

So when we think about those requirements we not only think about what gets tested, what they're being tested to. And we're going to have to develop again those test requirements in the performance verification project. And we're going to be looking sort of along those lines that these larger, higher pressure ducts may actually have tighter requirements, because they are at higher pressure than the other systems.

In terms of the unitary single zone proposal I really encourage that for a couple of reasons, I guess. One is we're finding, in fact PG&E in their case initiatives last year, did some research as well as some other folks who have been finding that it's fairly typical that residential

type thermostats get used on a lot of commercial equipment.

And essentially what you end up with is a situation where your fan is either on 24 hours a day, 365 days a year because the time control doesn't allow it to go off; or the fan cycles with the heating and cooling cycle, in which case it's off during building occupancy when you don't need heating or cooling.

Both of those situations are creating either over ventilation or excessive energy use of under ventilation. The problem is if you actually keep the fan on during normal operation you end up using a lot more energy than you're currently using. And so it actually, interestingly enough, shows up in some of the EIA data where package equipment is actually using less energy than belt-up systems.

I'm convinced that part of that is because the outdoor air system, you know, the system just cycling with a fan and you're not getting your full ventilation use. And one of the solutions of that is go to two-speed motor or VFD fans, something like that, to help reduce that energy use when you don't need heating or cooling,

but you do need ventilation. And so I think for larger equipment it makes a lot of sense. And it may even be investigated smaller equipment.

The other thing I'll note is there are two manufacturers that are currently developing some very sophisticated controls for small package equipment that could, in fact, accomplish this. They're partnering on that. I'm not aware of all the details, but I do know that Honeywell and Trane are working on an advanced controls package. And that the Institute, partly through the PIER research that we're doing, is working with the Consortium for Energy Efficiency to try and develop a project to bring that into the market. And we're hoping that they adopt this two-speed motor VSD, so there may be actually control product available in the next couple years that helps also deliver this.

A comment on the dampers in the envelope section. That is currently in the ASHRAE standards a mechanical requirement, even though the architect may be specifying the damper. And so I think you need to get clear about whether that's an envelope requirement or mechanical requirement. I think it's kind of confusing.

The other thing is there is a code conflict with that, particularly where there are no fire or smoke safety systems. We need to be clear about that because the Uniform Building Code does require those to be open one-third during normal building operation. And so we need to make sure that that's addressed there.

MR. PENNINGTON: This is the elevator shaft dampers?

MR. JOHNSON: The elevator -- stair and elevator shaft damper requirement --

MR. HYDEMAN: Actually the UBC section that I saw claims it just has the -- the one that I cited claims that you can only use manual dampers as if manual dampers somehow perform better than automatic dampers. But there's no opening requirement.

MR. JOHNSON: Yeah, the International Building Code has actually corrected that. It has an opening requirement and that's probably when California updates its building code, if they ever do. Get through this morass of the other side of the aisle on code stuff -- to do with that, so, good.

In terms of the VAV fan, I think the

acceptance requirement's the key to that; I would encourage to work together on developing the acceptance requirements, testing to make sure that that's implemented.

On the central plant unloading, we've talked about trying to potentially have a credit for that, and verifying that. That would be one way to do it, if you provide load profiles and do a reasonable job of sizing your plants, either VFD chilled water plant or maybe even multiple equipment, that there's some way to achieve a credit. Because right now you can meet the standard by supplying a minimal compliance COP chiller. And, you know, a size that you can justify and that basically meets the requirement. And so there should be something more for those other folks.

One other comment, testing on controls. I just mention EPA has a grant, the Iowa Energy Center, to form something called the National Building Control Information Program. They are going to be testing controls, sensors. They're going to be naming names; recording results. And I think it's going to be an important thing for certification programs for looking at exactly if

we do get down the road and start looking at canned programs and requiring control certification, that there is a program in place that we may be able to rely on to get some of that information into this process.

And finally, in terms of the outdoor air measurement piece, I'd like to talk some more about technologies to do that, just because as a part of verifying outdoor air there currently is a completion requirement in the standards. It's the only performance verification requirement in the standards. And my guess is that the technologies there to do that are not well understood or well used. It's something worth focusing on.

MR. LEBER: Martyn, you had your hand up awhile back.

MR. DODD: Well, Michael left unfortunately, but the perform 95, perform 98, perform 2001, comply 24 and energy -- had outside air precooling, evaporative precooling, indirect, direct, as well as stand-alone evaporative cooling in there.

So that was an effort that was put through the CEC back in, I think, '94. PG&E funded that, Peter Schwartz. So really -- and

they use EnergyPro, so they probably need to give me a call --

(Laughter.)

MR. DODD: -- they're able to do it, so they ought to take credit for that. So there really is no issues with the precooling stuff there.

ACM maps. Mark talked about the remapping of the HVAC systems on the ACMs. And, of course, I've been behind that for quite a number of years, as is SDG&E.

What I'd like to suggest is it's going to be a fairly significant change to the energy budget that's going to be generated for the 2005 standards by mapping to a different system.

And right now, then, the current map caused a lot of problems with people's understanding on doing a package VAV system, on being compared to a built-up chilled water system, why is it pumps. Why do I not have pump energy, et cetera, et cetera.

So that will clear up a lot of those issues. But what I'd like to suggest on that is that this current savings by design incentive programs that are around in which we do, in fact,

use different maps. And right now we're using a map that's kind of similar to the ASHRAE 90.1.

So what I'd like to suggest there, if you want to have the contractors develop that language for the ACM manual early, I'm sure I can get SDG&E buy-in and probably the other utilities buy-in to have that on the table and in place and working for the next couple of years prior to the 2005 standards.

That will give us the ability to shake out any problems that we're going to see there. We're not going to use it for Title 24 submittal purposes or compliance purposes, but really just for incentive calculation purposes.

The advantage of that is all of the incentive calculations are reviewed very rigorously by the in-house engineers at the utilities, so we get the added advantage that the stuff's all going to get checked out. And if we see any problems with it, we can shake that out early.

MR. LEBER: Bill, you had a question for Martyn?

MR. PENNINGTON: Yes. You said you thought that this changing the maps will have an

energy budget consequence, significant energy budget consequence? Do you --

MR. DODD: Well, as an example, right now if I do a, let's say I do water source heat pump system. Okay, water source heat pump system, it's going to get compared to a packaged single zone rooftop system. So that system uses significantly different amount of energy use than a water source heat pump system.

So, as soon as I change the map and I say, okay, if you're putting in a water source heat pump system, you're going to get compared to a water source heat pump system, right away that energy budget has changed.

MR. PENNINGTON: In what direction?

MR. DODD: In the case of the water source heat pump system we're probably going to see the energy budget go up. Okay, because the water source heat pump system has a lot of other residual energy use.

MR. PENNINGTON: To some extent that will be an issue for the Commission if that's, you know, the direction this is headed.

MR. DODD: Um-hum, yeah, definitely. Well, it needs to be looked at carefully because

there are going to be some mappings that are going to cause -- another example, I'm not sure if what happens with air cooled chillers in the 90.1 map. Is that mapped to an air cooled chiller?

Okay, so there's another example because right now Title 24 maps us over to a water cooled chiller. So that proposal there would map an air cooled chiller as being compared to an air cooled chiller. And theoretically an air cooled chiller probably uses more energy than a water cooled.

MR. HYDEMAN: All of this is obviously tied to the prescriptive measures. So, for instance, if we put in this prescriptive measure to limit the application of air cooled chillers, then they'd be mapped to a water cooled chiller.

But right now 90.1 is basically looking at condenser source, how the cooling is delivered, and so you would have systems with pumps compared to systems with pumps, systems with water cooling compared to systems with water cooling. So it's more of a like for like. And I think it gets rid of some of the issues that you're talking about.

Nonetheless, Bill, it is absolutely clear that you change the map, some things will have a larger budget, some things will have a

smaller budget. And in aggregate we won't know unless we rigorously test those maps across a wide range of systems and climates.

And they have always been set up, not by life cycle cost analysis, but by kind of a consensus of experts as to what represents the best baseline for the systems.

MR. LEBER: Do you have a question for Martyn?

MR. MAHONE: Yeah, I've got a comment on that same subject, the mapping. For the TDV project we actually looked at this question of changing the California's mapping to the way ASHRAE did their mapping. And we decided it was better to leave well enough alone.

The ASHRAE mapping was set up with kind of a hypersensitivity to gas and electric wars, because that was kind of one of the major issues that was driving the whole process.

And as a result it basically every single system maps to the same type of system. Some of the kinds of tradeoffs that Martyn was pointing out that we decided were important in California when the California map was set up would go away.

Just to give you another example, under the ASHRAE system a gas absorption chiller is compared to a gas absorption chiller, whereas in California it's compared to an electric chiller for the baseline.

And so when we looked at it we decided that there was actually a fair amount of wisdom in the way the California map was set up and decided not to touch it.

So, if you want to reopen this issue I'd put everybody on alert that you're opening up a major issue.

MR. GATES: Can I expand on that?

MR. LEBER: Steve.

MR. GATES: With some systems, for example water loop heat pumps, Martyn commented they seemed to use more energy. And there's a reason for that.

They've been heavily promoted in the past as being highly energy efficient for their ability to move waste heat from one side of the building to where cooling on the other. And when you really look at buildings you find out, jeez, that's really not what's happening in buildings.

So, I don't necessarily feel that it's

necessarily bad that it's compared to a system that's actually more efficient. So, you know, there's certainly I'm not arguing either way in terms of whether the map should be changed or not. I just wanted to kind of, you know, add comments to the discussion that similar to what Doug was saying, you know, if you always compare an apple with an apple, you're precluding the consideration that maybe you should really be looking at an orange.

MR. LEBER: There were a bunch of hands up out here. Ahmed.

DR. AHMED: I have just a couple. Ahmed with Southern California Gas, just a couple of questions. One question to Mark. You mentioned that we should have a standard for equipment not covered by EPACT and NAECA. What equipment do you have in mind?

MR. HYDEMAN: Well, the HVAC equipment efficiencies for which we have curves, cost curves that were developed for 90.1 include things like electric chillers which are not covered by EPACT. In other words, there's no federal preemption on efficiency levels for chillers, specifically addressing EPACT.

But there are also curves for package terminal heat pumps, which, I believe, are covered under EPACT. And so our first step here is to try and look, of the 36 curves we have, which ones are covered by the exemptions, which ones aren't. And then to move forward from there. And I give you a comprehensive list offline.

DR. AHMED: Another question. Jeff, you mentioned about -- unloading, what do you mean by that? I didn't quite understand.

MR. JOHNSON: I believe it was a proposal to look at -- one of the proposals was to look at chillers, and is there a way to better match chiller, the load profile of the building, the load profile for the chiller or chiller plant, the multiple -- Mark, is that one of the --

DR. AHMED: Is it like staging?

MR. HYDEMAN: It was merely -- this simply is in 90.1 and it just says that if you have isolation zone controls, so you have like ten zones that are over 25,000 square feet, so you break it up into ten zones or whatever.

That you make sure that your central plant is designed such that it can operate stably when only one of the zones is operating.

There's specific words in 90.1. We're not suggesting adopting those words, but the philosophy is one where you design the plant so it can unload to the minimum number of zones that you would anticipate.

DR. AHMED: One final comment. It looks like we're looking at a lot of control strategies right from the cooling tower all the way to the reset controller of the variable volume -- and I don't know if all of these savings are additive. They are probably not.

So I think it would be a good idea to take a look at the systems approach instead of each measure individually. Because they all interact with each other.

For example, I'm not quite sure whether we can have variable speed drives at the same time variable speed pumping unless you have some sort of a primary secondary loop to manage it. Because they could be sort of fighting against each other.

MR. GATES: Not necessarily. I mean most chiller manufacturers will now say that their chillers can be safely run down to about one-third flow. And it's about one-third of normal flow that you start getting transitions into laminar

flow where all of a sudden you have severe changes in heat transfer characteristics.

But, there are certainly minimums. And minimums have to be recognized. The minimums are -- when you look at the minimums, though, compared to what's happened to the pumper fan horsepower in the interim, you know, the vast majority -- fans and pumps, when you start unloading them typically -- well, the guys who really like to promote VFCs will claim that horsepower goes as a cube of flow. And that's never true in reality because of the fact that not all components in the system have pressure drops that vary as a square of flow, and then you put, your control sequence is overlaid on top of that. Such as pressure sensors, and stuff.

But nevertheless it does tend to go as at least a square of -- horsepower goes at least as a square of flow. And what that says is, jeez, if you can just get the flow down to 70 percent of design, and run it there the vast majority of hours, you're under half horsepower.

And you're still well in the range of where equipment runs well, you know, where chillers can still handle it, you know,

particularly in larger plants where you have multiple chillers anyway. But even in smaller plants there are well known engineering techniques for measuring flows and either using some bypasses to maintain minimum flows or going to primary secondary. It's a very well understood situation.

MR. LEBER: Other questions? Carlos.

MR. HAIAD: Carlos, Southern California Edison. We have done some work, testing that shows great savings -- but, as a central plant as a whole, savings are heavily diminished.

So if you draw a circle around the chiller you get 30 percent; if you draw a circle around the central plant a 30 percent drop to low single -- 3, 4, percent. Then the cost effectiveness becomes an issue.

This is not a paper study. This is actual installation that was measured before and after.

So the approach of system approach is very valid, -- physical components and see how they are doing. That's very important.

MR. LEBER: David.

DR. GOLDSTEIN: I just want to reiterate the point that Doug Mahone made about system

mapping. This is basically an energy efficiency requirement. And when you look at what the map is, you're requiring or not requiring something. And the examination should be done in that light.

If you're going to do it you should also think about what's the right answer for an incentive program because it may not be the same right answer as for the code. And it's going to be just as much work to do both at once as it's going to be to do either one of them separately.

The best example I can think of for that is on the residential side where evaporative coolers are not given credit as an energy efficiency measure for code compliance, because yet double the efficiency of the cooling system and double the load, and you're really not where you want to be.

But for an incentive program it could be completely different. If you've got the same load and now you're trying to meet it with an evap cooler, that's real energy savings and you do want to credit it.

There are lots of examples of that where the basecase would be different. So to the extent you're looking at it, think of both of them at the

same time and maybe we can get some statewide uniformity on calculational methods for the incentive programs.

MR. LEBER: Other comments? Mark.

MR. HYDEMAN: Yeah, I just wanted to suggest perhaps a way to step forward. First of all I'd like to say that David and I grappled with this issue on system mapping for years when he was the Chair of the ECB section for 90.1, and I absolutely concur on this issue about separating code mapping from incentive mapping and the issues there.

What I would suggest, and I'd like to work with Martyn on this if we move forward with it, and that is that we identify specific loopholes that we know exist in the current mapping.

And also identify problem systems. And under problem systems I would suggest that under floor air distribution systems which we know from very detailed life cycle cost analysis can be quite energy efficient, under the current mapping would be penalized for fan energy that doesn't exist in the real building.

So, there are problem systems and there

are loopholes. Identify those. Try and come up with a recommendation for how we close the loopholes and credit the problem systems appropriately, and then kind of see where it lands.

And try and get some broad consensus from a number of groups. The utilities, certainly, we'd want involved in that. You know, Martyn, you obviously have to be central to this, and Doug and others.

So that's what I would propose as a method for moving forward.

MR. LEBER: Nehemiah.

MR. STONE: One very general, one very specific comment. Generally, and this has come up in terms of a number of things, but just for example, the dampers for elevator shafts.

When we talk about what the code requires let's be careful we don't go back and look at the UPC or look elsewhere. That's not what's enforced in California. It's the state building code, and the state building code has as many pages different from the UBC as it has the same. So let's make sure that we're looking at what the requirements are in California.

The specific thing, and this doesn't solve all of the controls issues, but one of the things that Jeff brought up was residential thermostats being installed in commercial uses.

We made a recommendation last time, and I'll reiterate it, it's a very simple solution to that one problem. And that's to require that residential thermostats be labeled not in compliance with CEC requirements for nonresidential use.

You know, a lot of these things have -- they put, you know, the manufacturer puts a label on it that says complies with CEC Title 24 requirements. For residential, yes. And so it gets installed; inspector looks at it; well, this complies, that's all I have to know about it.

They need to say clearly these are not, they don't comply with nonresidential requirements.

MR. LEBER: Martyn.

MR. DODD: Okay, couple of other topics. Demand controlled ventilation. At a lot of seminars this year and a lot of building officials, a lot of designers. And that topic was discussed a lot.

And in talking to a lot of the equipment manufacturers I'm finding that incremental costs on that measure, Carrier tells me it's about $300 on a package unit, okay.

Now, right now it's required on systems 3000 cfm of outside air. I'm guessing if you have your contractors do the analysis you're going to find that's cost effective way down closer to about 1500 or lower cfm of outside air.

And nobody flinched at the suggestion that they had to do that. At this point the equipment manufacturers have come up to speed with the dcvs, they're integrated in most of the packaged units. By 2005 we can expect that it's probably just going to be mainstream technology.

Right now, for $5 additional you can purchase a thermostat in which you have the CO2 sensor in the space. So the cost is nothing. So I suggest that we -- that you consider driving that number down considerably. And as Mark said, take it into some more occupancies as an energy savings measure.

Variable speed drives. Pumps, variable speed drives, fans. We're seeing variable speed drives on fans in the 15 horsepower range all day

long.

Now the problem right now is that 15 horsepower it's a huge credit. So, because the 25 horsepower is the threshold. So, if you're doing performance based compliance the fan energy usage is considerably lower. And I'm betting that if you do the math on that one you're going to find that that one's cost effective down considerably lower in terms of the horsepower range.

Some engineers have thrown out to me the number 5 horsepower as the cost effective point. Maybe that's a little extreme. Maybe by 2005 that's not, though.

So, pumps, same deal. Pumps, variable speed drives on pumps -- the only time we don't see the variable speed drives on pumps is where they go primary only. A few engineers will go the primary with primary variable speeds. But that one's just starting to take off.

But definitely on the primary secondaries, they're always putting the variable speed drives on the secondaries.

Outside air. The ironic part about Title 24 is that I can design a building and put in 100 percent outside air, grossly oversize my

mechanical system, and there's nothing regulating that.

I think we should consider having some sort of maximum on outside air. A lot of people ask me that question at seminars. Isn't that my maximum outside air. No, that's your minimum. You can go above that number, okay.

So I don't know what the right number would be. Maybe it's no more than 10 percent of the Title 24 number unless you can show justification, force people to really prove that they really need more outside air. Because outside air is a big energy user.

Last topic. And I know this one's being discussed; I don't know if it's on the table for revision in the 2005 standards. But large boilers on domestic hot water when we're dealing with high rise residential and hotel/motel.

That tends to be a huge credit because we did compare to this 50 gallon water heater that's in every single unit. So it's so much of a credit that even under the 2001 standards if you go with that type of system you can get that type of building to work with electric resistance heat. So that tells me right away that there's something

wrong. We shouldn't be getting that sort of credit. We shouldn't be -- sorry, Edison -- we shouldn't be getting electric resistance heating buildings to comply.

So, we need to look at that one. And that's the loophole. Any energy consultant, Title 24 energy consultant that knows their stuff knows about that one. And that's a hole in that calculation.

MR. LEBER: Thank you. More questions, comments? Jeff.

MR. JOHNSON: Just two historical points. One is the current VFD requirements in the standards are based on adding on a field-installed variable frequency drive on a package rooftop VAV unit.

So basically that was the basis that was run in the analysis that Eley did under contract to the Commission back in the '90s, and that's why it's 25 horsepower. So I think we can do better than that today.

Second. On the 100 percent outside air requirements, if any of you around recall we've had a lot of discussions about ventilation requirements. One of the unique things about the

State of California is that this body decides what they are. That's unique to this state only.

At the time there was a push for 100 percent outside air as the standard by a group of individuals who were claiming that they were allowed to do that under the Americans with Disabilities Act.

We were able to go back to minimum rates, but we were not able to put a ceiling on those rates as a result of that discussion, and ultimately that compromise. So, the reason that there is allowance for 100 percent outside air is because some people think that's exactly what should be done so they can get access to buildings.

And so we didn't, the standards at that point in time decided not to put a cap on it. Although we did make sure that you couldn't do once-through systems. So you do have to have a return air system in the building.

So that's just a couple comments for the record.

MR. LEBER: Other comments on HVAC? Steve.

MR. GATES: Yeah, I had a question for

Mark on the low leakage dampers. Was this intended -- I guess I'm a little confused here. Typically when the building's running, because of outside air requirements you got to have some dampers open anyway.

And I've done layouts before where I actually relied on a little bit of that damper leakage, you know, using -- and particularly if I have a measured outside air system. And the demand control ventilation with the CO2 sensor is an excellent way of doing this so that you can be sure that you have adequate outside air quantities.

The question then is if you're now in this building and you need outside air, the fact that the dampers leak some, that just simply adds to some of the outside air.

And so it's not clear to me that low leakage dampers are actually a benefit. And actually previously, I don't know if dampers have changed in the last decade, but my impression of the dampers ten years ago was that the blade seals did not have the life as the damper assembly, itself, would.

And so ten years down the road you've

got seals that ar degrading. They're starting to peel off, they're hanging, they're getting -- they can interfere with the mechanism of the damper operation, itself.

So it was never clear to me, particularly in California climates, that low leakage dampers were a particularly good idea. You know, standard damper without the blade seals that could fail worked just fine.

And particularly once the building was running, again you need outside air. So the fact that the dampers leak a little bit, if that adds to the total, and you can measure that, then there's no penalty for having a leaky damper.

MR. HYDEMAN: If I may respond. There are two different conditions you need to look at, Steve, I would argue. One is the condition when the dampers are shut off because the building or that system is not operating.

And so there's an infiltration argument. I think that's really the basis for the outside air and exhaust air dampers, is one of stopping infiltration when the system is off.

The return air, which comes up in the economizer requirement, is one of saying that the

economizer must be able to provide 100 percent outside air. Well, it's hard to do that job when you're circulating air back through a leaky return damper.

I agree with you, I agree with you wholeheartedly we need to look at the technologies and make sure that when we look at the life cycle cost we look at the cost of maintaining whatever those seals are that are required to meet the AMCA levels in those tables.

And so we need to make sure that we account for the shorter life, if there is one, of the seals versus the dampers.

But I think there are very good reasons to look at low leakage. Again, infiltration on the outside, and exhaust, and then leakage for the economizer on the return.

MR. LEBER: Carlos.

MR. HAIAD: I had a question about economizer based on climate that the CEC -- expectation that in any climate the tonnage requirement would go up, or go down or we don't know or --

MR. HYDEMAN: I did this in AB-970, Carlos. What I did is I took the ASHRAE table,

which is climate based, and I mapped the climates for the 16 California climate zones.

In climates like San Francisco the requirement went down from 7.5 tons to 5 tons. And there were a number of climates where that happened.

Which climate zone is Barstow in? That's my favorite climate. Climate zone 14, you know, you could have a 20 ton or a 30 ton unit before you had to worry about air side economizers.

And so it became more climate specific. And some went up and some went down.

MR. HAIAD: I mention this because my experience with -- accounts, you know, they need 20 tons of refrigeration, air conditioning. And they put 5 or 4, 5 tons so they don't have to pay for the outside air economizer.

So I'm all for just -- put in 5 tons. Don't let them get away with it.

MR. LEBER: I don't know how many times we're looping around here. I really wanted to let Bill Mattinson have an opportunity to bring up the issue that he had on envelop that I cut him off on.

MR. MATTINSON: Actually I'm going to let that -- thank you.

MR. LEBER: Okay, Bill.

MR. MATTINSON: Appreciate it, Jon.

MR. LEBER: In that case, Doug.

MR. MAHONE: Yeah, I had a sort of continuation of this topic of climate zones. Also in your presentation, Mark, you had a couple of requirements that you were going to tie to heating degree days and or cooling degree days, and I understand within the ASHRAE context why the climate differentiation and the degree day differentiations were necessary. Because they were dealing with the full range of climates in the United States.

However, I think in translating that stuff into California, it's fundamentally one market as far as most of the HVAC world is concerned. Certainly from the manufacturers' perspective for most kinds of equipment it's basically one big market.

So I would just put in a general caution that we shouldn't be making fine distinctions between climate zone and further subdividing climate zones by degree days unless there's a

really really good reason to do it.

MR. HYDEMAN: If I could, Jon, just briefly. The only reason we've used the heating degree days as an example so that one can get a feel for where this requirement might land.

I would not propose that we go below the present or whatever would be the current climate zone distinction. So anything that we do I would recommend strongly that we maintain the integrity of the climate zones.

But I think climate dependency is something that we ought to look at in life cycle cost analysis for some of these measures. Air side economizers is a great example, because when they fail in Barstow they almost always do damage.

MR. LEBER: Okay, we'll move on to -- Jeff.

MR. JOHNSON: I would like to follow up on Carlos' comment. Pacific Gas and Electric Company prepared a case in issue that actually did not get presented in the AB-970 proceeding, and it had to do with lowering the limit for economizers.

And the analysis they did showed they were cost effective down to three tons using just a simple two-position economizer that was a

nonintegrated type.

Furthermore, when you do that you can create an economizer efficiency tradeoff procedure for those units that require higher EERs, and those units are available, the residential size units, and -- also under NAECA exemptions.

So, I encourage you to consider that. It also, part of that analysis showed that the most common unit in the state was a three ton unit. And that four and five tons were not far behind. The next most common unit was ten tons. So clearly the divide and conquer strategy is well known and well utilized. And if you drop it to three tons, I think you'd be closing a pretty good loophole in the standard.

MR. ELEY: Just a footnote on that. We've done a lot of research on schools. They tend to use one packaged system for each classroom, and they're below the 3000 cfm.

But they use economizers very widely in classrooms. They get the can-fab add-on to the packaged equipment. It's very commonly used.

MR. LEBER: Other questions? Martyn.

MR. DODD: Just one other thing. I've written a letter to Bryan and I wanted to bring it

up.

Could we consider diversifying the schedules that we use in the analysis that's done for the 2005 standards? Right now we've got this daytime schedule which is basically a 12-hour schedule that's applied across the board to pretty much all the occupancies except the high rise residential.

Occupancies such as retail obviously don't run on 12-hour schedules. They do run on weekends, things like that.

So the schedules that are in ASHRAE 90.1 are considerably more diversified. I think there's about 15 or so schedules in there. And there's a -- system or mapping of the schedules into the occupancies that we could use to go directly into Title 24.

I think that will give us a lot better analysis and a lot better measurement of energy savings when we roll out the 2005 standards.

MR. LEBER: Other comments?

MR. HAIAD: I fully support that.

MR. ELEY: I think another reason to do it is because of TDV. And just a historic footnote. The schedules that you referred to in

ASHRAE used to be in Title 24. ASHRAE took them from Title 24.

MR. LEBER: We have about one minute here, and I think I'm going to make a comment during that period.

Particularly about the last item. And the issue, one of the big issues we face with the schedule is that we don't know the occupancy of the building really. That you may know what it is today, but for a lot of buildings you don't know what it is tomorrow.

Now, maybe there's some clean and clear way of separating that out. And if we can define that clearly enough where there really are some building types that you can say, yes, we know this will always be what it is that we're saying it is on our first permit application, maybe there's some reason to go down that path.

But certainly there are a whole lot of buildings that are constructed that today they're a restaurant, tomorrow they're an office, the next day they're a retail store. We don't know. And modeling things in a different fashion and then trading away different efficiency measures because of that, based on this conclusion might be not the

best thing to do.

Particularly if they're envelope measures. Maybe there's some reason why systems have to change. But we need to be cautious.

We're now out of time. I conveniently used up every last second.

(Laughter.)

MR. LEBER: So, we'll be reconvening here after lunch at 1:30 p.m.

(Parties speaking simultaneously.)

MR. LEBER: Does everyone want to cut it shorter? Forty-five minutes? All right, we're going to shoot for starting up at 1:15.

(Whereupon, at 12:30 p.m., the workshop was adjourned, to reconvene at 1:15 p.m., this same day.)

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AFTERNOON SESSION

1:29 p.m.

MR. LEBER: We are going to reconvene the workshop. And the first presenter is Mr. Benya.

MR. BENYA: Fire when ready, Gridley.

Okay, we have a number of proposed measures here under nonresidential lighting. The first of these is a relatively simple proposal; it's a redefinition of daylit area, section 101. Currently the definition of daylit area is a fixed distance in from the wall. And we want to change that to 2.5 times the window head height, which is consistent with sort of a generic description of daylit area throughout IES and other journals of the industry.

Next, please. The second proposal, again is a simple proposal. Given the evolution of the electronic ballast, federal law and other things, it seems that we might take section 132, which is our long-standing section on tandem wiring, and simply eliminate it. Or revise it to mandate the use of electronic ballast, so it would have to be done in a way that doesn't step on the toes of the federal requirements.

Next, please. This proposal, variable light level. This is a proposal to drop the threshold of dual level switching or multiple level light control from 0.8 watts per square foot to 0.6 watts per square foot.

In AB-970 proceedings the threshold was dropped from 1.0 to 0.8. There was quite a debate about 0.8 to 0.6 at that time. At that time the group was sort of focused on 0.8 as being the best compromise. However, I believe the changes in the marketplace recently have made 0.6 an attainable number.

The next proposal is automatic daylighting controls. This proposed measure would require automatic daylighting controls, either stepped or continuous, in large spaces. Large spaces would be defined as something the size of a classroom or larger, would include things like concourses and retail facilities and atria and spaces like that.

Manual controls with daylight zones would still persist as they currently stand. And, of course, this is designed to insure that the harvesting of daylight in these significant spaces occurs.

The next measure, exterior lighting. This requires -- we're going to have to go back to yesterday. Yesterday we introduced a proposal to establish a new broad definition of high efficacy lighting to eliminate all the individual definitions that were beginning to pop up throughout the standard. We would use that one here, as well.

And therefore it replaces the language that was put in due to AB-970 for 60 lumens per watt, and simply reverts back to the universal definition of high efficacy lighting.

It affects all building types. One of the things that we're proposing we do here is focus on the notion that we don't want to discourage people from doing even some very nice lighting. But what we want to do is we want to discourage them from using a lot of medium-base sockets and other halogen and incandescent sockets for most exterior lighting.

The one exception that I think is an important new addition to this thinking is to take very cold regions and loosen that up a little bit. The reason for that is that in the low wattage applications HIDs are not very good sources, and

fluorescents don't work. So we would want to exempt them. And this doesn't affect much of the population. We think it's a pretty simple definition.

This one was a lot of fun to come up with. Common lighting systems. This proposal is to come up with what the current proposal is, anyway, a version similar to what the State of Washington does, where if you have certain lighting systems you don't have to do any calculations. You simply comply, prima facie compliance.

This proposal lists a number of specific lighting systems with spacings, so in other words, two-by-four troughers on eight-foot centers with two lamps. Which generally insures 1.0 watts per square foot or less connected load without anybody having to really think anymore about it.

I think this is a particularly interesting concept because it may reduce the amount of compliance documentation that needs to be performed, and the amount of compliance documentation that needs to be checked by the authorities. It's simple enough that I believe that the authorities will find it to be easily

enforced and easily implemented.

The next measure would be to revise the lighting power allowances in the complete building method. This would involve two things. Number one would be adding some space types or building types. This is to insure that we're picking up as many buildings, and when people feel they want to utilize this compliance methodology, that they can find a building that matches theirs pretty well.

The other thing is to update all of the lighting power density values. As we all know, there have been some important changes in lighting technology in the last five or six years. Some of them are fairly subtle, but they're there. And this may allow us to reduce lighting power densities 10, possibly even 20 percent, as compared to the existing values in some cases.

This measure is very similar but this applies to the area category method to perform very similar things. To check the number of space types; to add space types that need to be added; and to update the lighting power density list based on those efficacy and other improvements that have occurred.

This proposal, which involves maybe a

Title 20 proposal instead of Title 24, but we're putting it out there for discussion at this point, would require the use of pull-start metal halide lamps whenever metal halide lamps are being used. Primary reason is that frankly they're simply more efficacious both initially and especially over the life of the light source.

And there doesn't appear to be any economic disadvantage whatsoever. It's becoming very common technology. And I believe that a change in the standard and/or Title 20 would insure that engineers who are not paying attention or being rather careless about this would be forced to do what they would do if they only took the time to learn the advantages.

This measure, lighting alterations, invokes section 131, 132 and 147 standards for any lighting alteration. Presently the standard says if you change more than 50 percent of the circuits, et cetera. And what we want to do is say if you touch it you got to bring it into compliance.

The reason for this is supported by the notion that most lighting retrofits today, particularly with the utility rates being what

they are, you have extremely rapid payback periods and so the lighting alteration could be simply brought into compliance by doing a lighting retrofit to a system that doesn't comply already.

This one was another challenging standard measure to come up with. We looked at the tailored method; we're aware that the tailored method, although it's probably one of the most powerful and versatile methods of compliance available, it also requires in certain occupancy types a lot of calculations on a regular basis.

And in particular, the retail method is one where, as a designer you will redo the same calculations over and over and over again. And after you've done a few of these you come to the realization you're always doing the same thing.

Well, if you're always doing the same thing that can be put in a table. And if we put it in a table we can simplify the calculation for retail spaces, which is the primary use of the tailored method these days.

So this proposal adds a retail compliance methodology that simplifies and makes it easier for people to demonstrate compliance and retains the tailored method and fixes it, brings

it up to date with the IES in a ninth edition handbook which changed the illuminance categories and other things to which it relates.

This measure, the elimination of controls credits, focuses on not only the AB-970 changes, but also some of the changes being proposed here. And says, gee, whiz, if we're making a measure mandatory then why should we give credit for using it.

So, this would eliminate the controls credits for the mandatory measures and would only retain controls credits for some of the under-utilized measures that we still want to incentivize designers to take advantage of, such as HID and fluorescent dimming, demand management systems and automatic daylighting systems, especially in smaller spaces.

This measure addresses a loophole that has become pretty obvious in the standard as we drive the lighting power densities value down. Previously the standard has exempted from the calculations emergency egress lighting systems.

Well, it turns out that using generators or other techniques, many emergency egress lighting systems are normally on and serve as part

of the normal illumination of the space. And so by removing this exemption, if it was a normally on emergency lighting system, it has to be counted in the lighting power density of the space just like anything else.

That's it. Those are the measures that our team has proposed.

MR. LEBER: Thank you, Jim. Nice presentation. PG&E, Doug.

MR. MAHONE: Thank you. We have a couple -- well, we have basically three that we're going to be talking about.

The first one is automatic bilevel controls. This was an idea that we had considered for the AB-970 round of standards, but because the ground rules at that point were things that we could move quickly on that were not likely to be controversial, we tabled this one until this round.

The idea is that there are a number of spaces that are very common out there in the nonresidential world that are fully illuminated often 24 hours a day, seven days a week, but which are frequently unoccupied. Places like stairwells, corridors, even large storeroom areas.

And these are places that are natural candidates for occupancy sensor control, but they're also places where people are very uncomfortable with the idea of turning the lights all the way off even though the space is unoccupied.

So, if you believe that it would unacceptable to do full occupancy control for spaces like this, then the next logical step would be to use the occupancy sensor technology for half of the lighting or less. So that when the space is unoccupied you're down to 50 percent or less of the lighting.

This kind of system is actually quite common in other parts of the world. This is very typical of hotels in Europe, for example, that have the corridor lighting be entirely off unless you get out in the corridor. Then in a lot of those cases it's actually a manual switch with a little timer that shuts off the lights after awhile. This is kind of the more sophisticated and less user interactive version of that proposal.

It's easily accomplished either with partial dimming controls or simply switching of

alternative luminaires, or also in some applications using a high/low type of ballast where the ballast can simply switch to a reduced power level when the occupancy sensor tells it how to do this.

So, we're going to be looking into the economics; we're going to be looking into which kinds of spaces are most opportune for this type of control, where it could easily be applied.

If we get enough feedback from some of the targeted occupancy groups, like the hospitality industry, for example, that this might not be an acceptable mandatory control, then we would consider putting it in as a lighting control credit on an interim basis, and then making it mandatory. So that's that idea.

The next one Jon McHugh is going to be talking about for skylighting.

MR. McHUGH: Jon McHugh, Heschong Mahone Group. This is very similar to what the Energy Commission's consultant team has also proposed. And we have a couple of different issues associated with daylighting via skylights or top lighting.

And one of the first things just very

much in parallel with what the Commission team has presented, we'd like to review the definition of the daylit zone. The current definition of daylit zone is fairly analogous to having a spacing criteria of 2.0 or greater for skylights.

Traditionally lighting fixtures are typically spaced 1.5 times that spacing criteria. The expectation is that by looking at that daylit zone, either people will look at spacing the skylights closer together in order to have one continuous daylit zone, or if they do not have -- or if they choose to keep the space further apart, then actually some of the lights are controlled where there actually is enough daylight in that space, and other lights are not being controlled on a daylight control.

Also, we would be looking at requiring automatic controls in the zone. And we have two proposals available for that. One would be to use automatic photo controls. The other proposal would be to also allow the use of time clocks. So this would be very similar to requirements right now for outdoor lighting where you can either control lighting based on time of day, or by the amount of light that's out there.

The idea there is that there's fewer designers that are actually have much experience with photo controls, and of course there's a lot more that have experience with time clock based controls. And also that if you've paid for the cost of the time clock control that we expect that actually most of these designers will actually use photo controls which will, of course, save more energy.

And I think over the long term we'd also be looking at requiring photo controls in the future, code revisions.

We would also look at the lighting control credit for photo controls with top lighting. Currently there's a much greater credit given to dimming controls than switching controls. And related to this we would also take a look at the whole issue of whether or not a skylight is clear or diffusing, in that a diffusing skylight actually provides a lot better distribution of light, and actually provides more daylighting benefit.

Next slide, please. This graph here shows the energy savings from different control strategies. And on the Y axis what we see is

energy savings in terms of kilowatt hours per year. This is actually total energy consumption of the building which is cooling, heating and lighting.

And on the X axis what we have is the skylight to floor ratio. What fraction of the roof is covered with skylights. And what you see is that with systems that have fewer skylights, dimming controls initially provide greater savings. But if you look over -- systems with more skylights in the roof, then what you find is actually switching controls provide more savings.

And that has to do with the fact that when you turn off a switch light, you get all the savings for turning that lamp off. Whereas if you're dimming the lamp down to minimum, that fixture is typically consuming, for fluorescent, about 20 percent of its full rated power; and for metal halide you're dimming, you're actually looking around 50 percent.

So, given that, there's actually a substantial amount of savings using switching controls. And currently the standards actually don't give nearly the proportional amount of credit.

Thank you.

MR. LEBER: Thank you, Jon.

MR. MAHONE: The other two topics that you have on the agenda, the pulse start metal halide lamps topic we've already seen from Jim Benya. And the existing lighting in commercial buildings, I'm actually not sure what you're referring to there, but we do have some discussion of this reserved for the other section when we talk about existing buildings. So we're done with lighting.

MR. LEBER: Thank you, Doug. The next presenter is for Watt Stopper. Harold.

MR. JEPSEN: Yeah, Harold Jepsen, The Watt Stopper. And we submitted ten measure templates for consideration. Some of those have already been covered.

The first is in regards to controls for all buildings, and that is that right now lighting controls is only applicable to buildings that are considered conditioned spaces. And we would submit that that same energy efficiency that we already get from lighting controls for those type of buildings should also apply to all other buildings.

We've got millions of square feet inside the state of industrial facilities and warehouse facilities that are not conditioned that could greatly benefit from this.

Next measure is to clarify and change in the area control section of 131, section (a), and that is to clarify the interaction between what our area control devices, what's listed in there is other devices. And also the shut-off devices and overrides.

One of the problems I think has been prevalent in the code for some time, or in Title 24 standards, is a loose interpretation that we see out there where an override switch for an automatic shutoff system is allowed to be control multiple rooms.

The assumption there is that override is available for 5000 square feet, whether they're individual partitioned spaces or not. And what that ends up with is we get an override that turns on offices that may not be occupied.

and to bring that more into compliance with out manual, with our compliance manual, we would submit that those overrides need to be limited to just the spaces that they control,

each ceiling-high partitioned space. And that the language should be changed to enforce that better. It would eliminate the energy efficient interpretation that allows overrides to override multiple spaces.

Along with that is also to require manual on control for occupancy sensing controlled spaces. Oftentimes -- there are studies out there that people do sit in their offices, or that there may be brief occupancy inside spaces where they don't need the lighting on. Someone who walks in and puts a document on a desk, or potentially someone stepping in someone's office to see if they're there and they're not, will trigger an occupancy sensor to turn the lights on for 10 or 15 minutes, where it may not be needed.

I know of other situations where guards walking the building keep occupancy sensors on, cycling on and off all night long. Where by requiring manual on, the occupant can thereby decide whether they want the lights on or not.

The next measure is one that was previously talked about by PG&E, and that is providing some automatic bilevel control for corridors and stairwells. And where that might be

able to reach out and also pick up buildings that we're presently not doing any control in. The hotels and motels and our high rise residential buildings.

The next one was also covered by both the CEC and PG&E, and that is to have automatic daylighting controls. I think also when we talk about time valuation dependent issues that this is certainly one that during peak times can offer some relief. That we see a lot of coincidence between when there is adequate daylight available and when the peak load is here in the state.

The next one is to consider occupancy sensors in small rooms to be a requirement. We're suggesting rooms under 250 square feet. We're targeting the private offices. What we find in a recent study that's published in IES is that 67 percent of the energy wasted inside private offices occurs during a regular workday week right in the middle of the day. And that a time-based shut-off system wouldn't necessarily be trying to shut off the lights during that time.

And that by having occupancy sensors in there we could reap the benefit of that wasted energy in shutting the lights off. There may be

also some peak load reduction benefit there because of the fact that we are talking about daylight hours when there might be peak load that we could actually reduce some of the energy consumption.

Another measure that we've submitted, and this kind of goes back to the one we talked about earlier, in the area of area controls, but it puts the same language in the shut-off section. And that is to clarify that the shut-off override definition for time switch controls is limited to overriding just the space of the ceiling height partitioned area. And not allowed to do multiple spaces.

And, again, that's to rid the ambiguity that appears in the code. And also the ambiguity between the code and the compliance manual.

Next is inside our present Title 24 standard is that we ask to have circuited separately display lighting. And I think the idea behind that is that the display lighting can be shut off separately. But I think to help that more is that we could actually automate display lighting. And even the bilevel lighting, particularly in retail establishments, that we

would turn off -- next slide -- similar to what we're already doing under executive order D-19-01 for exterior lighting, we would do the same thing for the inside of retail stores. And that is to shut off half the general lighting, and also the display light in the stores when the store's not open.

And one of the big things there is that, you know, the retail area is one of the areas we have the highest lighting power densities. And we have the best opportunity to reap some energy efficiency by making sure those lights are shut off automatically.

The next one is providing bilevel exterior lighting. And this is following on the executive order D-19-01 that was already out there for retail spaces. But implement this across all buildings, is that we allow probably over, you know, maybe a 200 kilowatt load that the requirement be to circuit exterior lighting separately, so that some of the lighting can be shut off; potentially 50 percent of the exterior lighting can be shut off during times of limited use. You could still leave on exterior night lighting.

And the last measure that we submitted is to suggest, and this is for peak load relief, is to include controls in buildings over 25,000 square feet that would allow you to shed 50 percent of the general lighting.

This shed signal could possibly be a single signal from the facility manager, maybe tied in with the building automation system. Or maybe a power alert signal from utilities with the ISO. And that would allow us, as a state, to be able to shed loads in time of peak need.

Thank you.

MR. LEBER: Thank you, Harold. Do we have someone here representing Mike Gabel? Okay, if not, then I guess we will skip that item on the agenda.

Do we have someone here representing SunOptics?

MR. BLOMBERG: I'm just an advocate for daylighting. In Jon's presentation I wasn't sure whether he was recommending that we prescribe top lighting where it was efficable or not. And controls can be made so that they're both switching and dimming.

MR. LEBER: Please identify yourself on

the record.

MR. BLOMBERG: Okay, Jerome Blomberg, Sunoptics Skylights.

And so anyway I'm here to defend the benefit of daylighting, not necessarily to tell you how to write the code.

My presentation earlier suggested that prescribing daylighting was a benefit that outshone all other energy conservation strategies combined. And therefore it should be included in the standard.

MR. LEBER: Thank you, Jerry. Which brings us to -- did I miss somebody? Well, did you have a presentation to make? I don't -- no, okay. So we're down to the questions, we are down to the questions. Yes, and that was a question that you were bringing up?

(Laughter.)

MR. LEBER: Yes, great. Sorry, you were a few milliseconds ahead of me and I got confused.

MR. ANDER: Gregg Ander, Edison. The question is for Jim. You mentioned mandatory measure, I believe, to include -- control, some sort of daylighting controls in spaces over the size of a classroom or larger, so 1000 feet large

or something like that.

Would you tie that to some kind of a daylight factor or something, or something to assure that there is enough fenestration to let light in?

MR. BENYA: Well, that's a good question.

MR. ANDER: Yeah, but mandatory code requirement for a space like this.

MR. McHUGH: Yes, the answer is -- maybe I'm trying to be too simplistic here, but since we are defining a daylit zone, then if the space was a daylit zone, then it would have to have an automatic control system.

SPEAKER: I'd like to add something; that said, if I remember correctly there is an effective aperature definition for the daylit zone, as well, so that would define that.

MR. ANDER: Like a window/wall ratio or something like that.

MR. ELEY: It's effective aperture which is the window/wall ratio times the light transmission and glass. And for skylights, it's the skylight to roof -- to ratio of the daylit area, I guess, right? Again, with light

transmission factored in.

MR. ANDER: Jim, might there be any lighting neutral quality issues as they come up in terms of distribution? If you had -- windows or something --

MR. BENYA: Oh, boy. Well, obviously if a -- this gets back to the caliber of the lighting control system, and several of us have had side conversations about problems in the lighting industry presently with how well daylighting control systems work.

Obviously if you've got a ribbon window or punched windows an appropriately designed daylighting control system probably wouldn't dim as much, or would not control as much as a better designed daylighting system of some kind.

So, yeah, I worry a lot about quality because I think daylighting is an evolving area where we're just starting to think of it as a light source. And we're just starting to apply some of the measures we apply to electric lighting to daylighting, in terms of glare and comfort and other factors. And I think we've got a lot to learn.

But as a practical matter, Gregg, I feel

very strongly in favor of this idea because I think the daylighting control systems that we have available to us today, if properly applied, work well enough to tackle some of these very large areas that deserve to be controlled.

I walk through airports and concourses and malls and other spaces that are very very large spaces in which all the electric lights are burning and there's absolutely no need for them.

And if it got to be a problem in smaller spaces, we just might raise the threshold, as we do the research here. If we feel that a classroom, for example, is too small, then as we do the research on this issue maybe we raise the threshold to a value larger than a classroom.

But I feel there's a wonderful opportunity to harvest a lot of that onpeak load that skylights are designed to save us in the first place.

MR. LEBER: Doug.

MR. MAHONE: Yeah, I think it's well known that I'm a big daylighting advocate. And we thought long and hard in preparing our proposal about how to do this. And we frankly chickened out when it came to side lighting. Because

there's so many ways that you can screw up side lighting, and not have the daylighting controls work right, and not get good lighting quality and, you know, all sorts of issues.

It's orientation specific. You got to worry about direct sun penetration; you got to worry about glare; the controls are harder to do. So, if you can figure out a way to make it work for side lighting we'll do whatever we can to help.

But we frankly decided that for this round that we would have a lot more success if we just went with top lighting and skylighting in spaces.

And the other issue that we -- maybe we were being too conservative about, but was in the photo controls, themselves. Even in our top lighting proposal, as Jon was indicating, we felt comfortable requiring an automatic timer control for skylighted spaces because you pretty much know when the sun's going to be up and when it's not, and we have controls that work for outdoor lighting quite reliably.

But we weren't quite sure that the photo control practice out there at large was quite far

enough along to make it mandatory in all cases. So that's why we suggested requiring automatic timer controls and giving a credit for photo controls so that the people that did do the photo controls could do it -- were confident they could do it right, would have some encouragement for doing it.

But, again, if there's enough expertise to be brought to bear on how to make the photo controls work reliably, we'd be happy to support that.

MR. LEBER: Other comments? Jon.

MR. McHUGH: Jon McHugh, HMG. First off I'd like to support wholeheartedly the idea of having lighting controls in unconditioned spaces, as well as conditioned spaces. You're still saving lots of electricity by controlling lights in unconditioned spaces.

In terms of the main -- for the occupancy sensor, one of the issues that need to be addressed is that sometimes the lights go off when you're in the room. And you normally can wave your hand and the lights come back on. But if it was manual on, then you actually have to walk back over to the light switch, which might

encourage people to disable the systems.

I wasn't quite sure exactly what was being suggested for bilevel exterior lighting. He's talking about at least half of the lights would be, have a separate switch or -- I wasn't really quite clear what that proposal is.

And then also relating to Jim's proposal about revising the tailored method to the IES handbook, as I remember the new version of the handbook provides a single illuminance value for different spaces. And it no longer has different illuminance values for, for instance, the elderly or a task requiring speed, et cetera.

So, I'd be interested in hearing responses to those questions.

MR. LEBER: The next-to-the-last item was a question to Harold?

MR. McHUGH: That's correct, yes.

MR. LEBER: Yes. And, Harold, could you respond to that?

MR. JEPSEN: Sure. First with the manual on is that many of the occupancy sensor systems or manual on systems have a delay in them where they don't actually go to the manual on mode. You've got maybe 15 seconds to make

yourself known to the sensor. Or that you're still in the space before it actually assumes the manual on role. So, that would fix that one problem.

To the bilevel issue is that take for instance a car parking lot for retail sales for cars. And then as it lights, you know, we have a high amount of lighting out in those kind of spaces. And the issue there is that when the retail hours are over for selling cars, or for any other retail facility, that the lighting would be circuited such that by time base we could shut off a portion of those lights so they wouldn't have to burn all night long.

I know right now that because many -- in trying to comply with the thing that came out, executive order D-19-01 that many people had frustration with trying to implement that because the wiring was put in ages ago and it wasn't split up separately so they could control the fixtures independently, and that made an issue or a problem for that.

MR. MAHONE: So is the automatic timer part of your proposal?

MR. JEPSEN: Yeah, it would be an

automatic timer that would shut off those lighting, or it could be, you know, an occupancy sensor based control, as well, that would only illuminate area to a certain footcandle level and then allow it to reduce back down when people weren't there.

MR. McHUGH: You're not suggesting -- or I shouldn't put it in the negative, but are you suggesting that outdoor lighting be circuited so that you have uniform reduction in light levels, you know, checkerboard or that kind of lighting? Or just that 50 percent of the lighting have an additional time clock in addition to whatever type of control you have for the photo control or whatever?

MR. JEPSEN: Just like interior lighting. It would be a uniform reduction. So, you know, maybe on fixtures where you've got two heads, you would turn off one, but it would be some --

MR. SHIRAKH: Can I get into this, this question of outdoor exterior lighting will be considered under a separate proceeding when that happens, so I don't think we need to spend a lot of time here to pinpoint the exact details of --

MR. BENYA: It's a little bit more complicated than it seems, once you get into some of the issues. And, yeah, we'll be taking a look at that soon. Thank you, though, it's a good suggestion.

MR. LEBER: Other comments? David.

MR. McHUGH: Well, there's a question to Jim, too, as well about the tailored method and -- did you already address that?

MR. BENYA: Well, there was some significant changes with the 9th edition handbook. It only changed what the illuminance categories mean, but it changed its -- it confirmed a definition of ambient and task lighting that was never really confirmed.

And we have to understand all those impacts. You know, if you read the tailored method, it's pretty specific in referring to specific IES handbooks and all that. That obviously must be updated.

But it has some subtle impacts, as well, and we've got to go through each line of that and make sure that it's very consistent. And it will reduce the lighting power density, by the way. The net effect of the IES recommendations in the

9th edition handbook will reduce lighting power density.

MR. LEBER: Thank you. David.

DR. GOLDSTEIN: Yeah, David Goldstein, NRDC. A couple of, I don't know whether they're questions or comments, so I'll word them as if they're comments, and the answer may be we're already doing it that way, in which case we can save time.

So the first one is on Jim Benya's presentation about reduction in UPDs for some spaces based on newer technologies. I would hope that that would also include the tailored method.

During the last go-around we reduced the tailored method UPDs by about 20 percent based on just sort of generically sold state ballasts and T8s versus the older equipment. And something comparable on the incandescent side.

And the same 10 percent-ish improvements from, you know, the new series T8s and so on would seem to apply across that sector, as well.

Concerning Doug's proposal about bilevel switching for usually unoccupied spaces, I think that's a really good idea. The two suggestions I would have are I seem to recall that a couple of

the successful case studies the low level was much below 50 percent of the high level. So we ought to look at what percentage is the reasonable low level percentage.

And then second you talked about an eventual mandate. The eventual mandate should have a fixed year attached to it. So we adopt it and maybe it doesn't go into effect until 2010, but whatever it is, it's a fixed date so we're telling the industry get ready for this, it is going to be happening sooner or later.

Concerning the mandatory daylighting controls, it seems to me one additional option might be to require lower UPDs in the areas that are daylit, as an alternate, on the concept that since you're probably only going to be lighting to that level at night, and you're not going to be getting the productivity benefits of higher illuminance levels most of the time anyway because the daylighting is going to override it, the optimal illuminance level would be lower. And if you put that in instead of the controls that would be another way of meeting the requirements.

It's really, I think, very similar in concept to this time clock idea. So that might be

another alternative.

Finally, concerning top lighting, seemed to me that we would get some significant energy savings if we require top lighting. Said that every roof has to have a minimum of X percent in skylights, and the resultant energy savings from it. Because all buildings have roofs. It's real easy to model in the performance method. And if you don't want to do it, well, trade it off against something else.

MR. LEBER: Thank you. More comments?

MR. GATES: I just want to ask a clarifying question about what David said. If I understood you correctly, David, you were saying that you think it would be a good idea to give, as an option against some controls a lower LBD?

DR. GOLDSTEIN: For specifically daylighting controls. In other words, if you have an area that's daylit and you were going to light it to 500 -- and you're supposed to save 40 percent maybe in alternates, lighting it to 300. And as long as -- the issues are you don't want to have a lousy lighting design that just makes people put in a bunch of incandescent desk lamps.

But, so you may need some other

requirements on what kind of equipment you've got to use or something else in order to take advantage of that pathway towards compliance.

This is actually from a study that Bob Clear at LBNL almost did on luminance maintenance controls --

(Laughter.)

DR. GOLDSTEIN: -- where the point was that the illuminance levels you get out of the IES hand -- pardon?

SPEAKER: Can we quote that?

SPEAKER: What year did he almost do that in?

(Laughter.)

DR. GOLDSTEIN: -- but what he realized when he was doing the analysis is that the lumen maintenance controls made a lot of sense if you assume that there's no productivity benefit loss from the dimming when you're above the IES recommended levels.

But the whole reason for the IES recommendations is a tradeoff between productivity versus energy use in lighting systems. And there is, at least in theory, some benefit of the higher luminance levels.

So if you're only using the electric lighting system a quarter of the time because most of the time daylight's taking over, the optimum illuminance level is lower than what IES tells you, because they're basing it on eight hours a day.

MR. LEBER: Jim.

MR. BENYA: To respond to David's point about reducing the lighting power density levels including tailored, there are at least three or four significant technical evolutions that will definitely take us in that direction.

Specifically I think in the tailored area the ceramic metal halide and its ability to be used in retail display lighting is going to be one we're going to evaluate very carefully on a life cycle basis, you know, as we go forward. It's real close to doing it, you know, it's real, real close.

The advances in T8 and T5 technology which are significant. And, you know, to a lesser extent compact fluorescent and some other areas, induction lamps, et cetera, there's been enough improvement in all these areas that if I had to, you know, estimate a value that we could be

looking at, it's probably at least about a 20 percent differential. Not universally, not in all places, but, yeah, I think it's there.

MR. SHIRAKH: Just one clarification of our 1998 LPDs were based on T8 electronic ballasts with a lumen efficacy of 87 lumens per watt, which is pretty efficient.

So I want to caution actually against high expectations of savings, given that it was based on the 87. And we used light loss factors and lumen depreciations in line with ASHRAE -- IES was recommending.

So there will be potential for some savings, but it might be limited in some cases.

MR. LEBER: Jeff.

MR. JOHNSON: The whole issue of controls is again, you know, something I'm really concerned about here. In the RLW baseline study they showed the buildings built since 1992. There really wasn't a lot, I mean looking at the shape of the curve for time of day use, the schedule of lighting.

All buildings are supposed to have some time-of-day control or some automatic lighting in the larger buildings, and it does not show up in

those lighting curves. I mean they're getting lights on, maybe, you know, 5:00 in the morning, and they're going off at close to midnight. So it's clearly the janitorial staff still operating the lighting in these buildings.

And so we're not sure if these controls are really working. The ones that are currently required in the standards, let alone ones that we might propose.

The one good news that came out of that study is that buildings, about 12 percent of the buildings in 1998 have daylighting controls. And that's up from about 2 percent in 1994. So, people are utilizing daylighting controls.

And my guess is it's a lot based on top lighting applications, they're the more successful applications. The open loop systems tend to be more reliable than the closed loop systems, and so that seems to be going pretty well.

And finally this is going to be a subject of verification, performance verification work that we're working on. It's verifying lighting controls, particularly controls for credit. So, we'll make sure we stay in the loop on that.

MR. LEBER: Bill, you had something?

MR. PENNINGTON: A comment related to that that I would have is the research work that PG&E did with the Lighting Research Council -- is that the right term, LRC -- Center, thank you.

Basically it concluded, my understanding is, that daylighting controls for side lighting applications are not there yet. I mean we really don't have a quality product there. Not something that, you know, you want to rely upon.

So I think doing, you know, a big push to do daylighting through side lighting is a problematic area until we have controls that are really effective.

MR. FELTS: Bill, if I could add to that. That study was not just for side lighting, but it also said daylighting controls in general do not operate very well. Now that study is about two or three years old now, and I think some companies, such as Watt Stopper, have been making progress. But I don't think we're there yet.

So lighting, daylighting, photo controls are problematic, there's no question.

MR. LEBER: Thank you, Don. Ahmed.

DR. AHMED: Well, I just wanted to

comment that I share Jeff's concerns regarding lighting controls. It is one thing to show the cost effectiveness on paper, but whether or not it will really be practiced is a question, especially if we start providing overriding switches and things like that, whether in reality to savings will be realized through the standards.

And the second comment was on the retail industry, we're talking -- the suggestion by Jim was that there should be controls to lower the lighting when the stores are not occupied. But consideration should be given to the fact that some retail operators want the lighting to be on during unoccupied times because they want to advertise their product.

And second, there are certain considerations for safety and security, as well. So those things should be taken into consideration.

MR. LEBER: Steve.

MR. GATES: I had a question for Dave on the concept of designing a lighting system to a lower lux assuming that you have daylighting available.

In the scenario where say you design the

system for 300 lux, assuming that daylighting on top of that would give you 500 lux or greater. What happens on a day that's cloudy?

DR. GOLDSTEIN: What happens on a day that's cloudy is the productivity of workers in the space is ever so slightly reduced. But it's not like you can't see. I mean most people have ten times lower illumination levels than that in their homes. So it's not like you're going to trip over the furniture.

What you're doing is you are giving up a small amount of productivity during the gloomier hours of the year because you can't justify the increase in productivity based on the increased light level which is provided during hours where you generally don't need it.

MR. BENYA: If I might interject --

DR. GOLDSTEIN: I'm not saying that's the best way to go. I'm saying that's an alternate to controls if you want a design to end that way.

MR. GATES: I guess I have a -- one problem I have is I keep reading things more recently about, you know, a growing awareness among health care professionals about seasonal

affective disorder. You know, people whose overall metabolism starts getting out of whack because they're not exposed to enough light.

And so I don't know, I have -- personally I think the ideal light levels are about 2000 lux or so, but, of course, that's not realistic in buildings --

(Laughter.)

MR. GATES: It certainly is, you know, I know if I get a lot of light I just feel better overall. And, you know, make it a point to do -- I do a lot of bike riding and other things for exactly that reason.

MR. LEBER: Jim.

DR. GOLDSTEIN: Well, from what I've read about SAD you have to be outdoors anyway or else have UV impacts, fluorescent lights. It's not a question of the illuminance level, it's a question of spectrum --

MR. BENYA: Just a couple of points. First of all, to David's suggestion. One little tweak that goes with that is since I'm designing systems exactly like he's describing these days, what we are doing is we are taking advantage of, even on a cloudy day you have a little bit of

daylight.

Generally we design daylighting systems to provide some multiple of the electric lighting systems we would provide in a room with no skylighting at all.

So the peak skylighting levels on a very sunny day might be several times what you would design an electric lighting system for.

But on a cloudy day you may only get, you know, 5 percent of that. But 5 percent of that, plus the electric lighting system already achieves the IES recommended lighting levels.

So, in general, you're never failing to meet the IES recommended lighting levels, even if you're using the suggestions that David has made.

Secondly, to seasonal affective disorder, and there's a question of spectrum to a certain extent, but it's primarily a function of how much, when, for how long. And the blue end of the spectrum, not ultraviolet, seems to be the most important component.

It does require a period of exposure early in the day; so in other words you're setting your body clock to convince your body you're at the equator, and you're not near the north pole

like where I live, it seems, this time of year.

And, you know, those sorts of things are part of the treatment of SAD. But SAD does require a light level in excess of 2500 lux even to begin to have any effect.

So, the best thing you can do is very early in the morning expose yourself to as much light as possible, which generally means getting outdoors. That generally works until you get up as far north as Jeff and I live, and then it starts to get to be a little bit more problematic.

(Laughter.)

MR. LEBER: It's not early in the morning anymore.

MR. JOHNSON: So we come down here.

MR. LEBER: Hang on, we have --

MR. GATES: Can I just clarify, so when you design the daylighting system when you have full sun what lux levels are you actually having in your spaces, then?

MR. BENYA: I will give you a very good example. Recently designed a gymnasium where the gymnasium can achieve a peak daylight illumination level of 200 footcandles average well distributed throughout the space.

I ordinarily would design an electric lighting system for about 50 footcandles. Okay, my electric lighting system is designed for actually about 40 footcandles because I know -- well, I'm cheating a little bit because I do design it for 50, and then I dim the heck out of it.

But the primary reason is because I need those 50 footcandles for night basketball games. But, you know, during the day I'm utilizing dimming to manage that system and try and keep the lights off whenever possible.

MR. GATES: Okay, but you are designing your overall lighting system to deliver a substantially higher lighting levels than you would if you just use electric only, is that a --

MR. BENYA: Oh, goodness, yes. See, that's how you account for weather and seasonal issues and everything else. If you were to design the interior light levels for maximum, for a peak of 50 footcandles, depending upon where located, you might never see more than 10. The average is probably going to be about one-quarter of the peak.

MR. GATES: Yeah, I would love to work

in one of your buildings.

MR. BENYA: Yeah, you would.

MR. MAHONE: That's one of the big advantages of top lighting is it's the cheapest way to really get a lot of light into a space.

MR. LEBER: Jerry.

MR. BLOMBERG: Jerry Blomberg. I just need to refute the deal about controls not working. WalMart is daylighting all of their stores. They use a combination of dimming and switching. And they have it in 500 stores. It works. They wouldn't keep doing it at the rate of three or four stores a week. So that's not a rational argument to not consider daylighting to work and save energy.

MR. LEBER: Comments? Harold.

MR. JEPSEN: Along with Jerry, the issue again is like it was with the HVAC earlier. And that is a matter of commissioning for the controls to work properly.

And so we've had similar experiences with other retail stores and school facilities that are doing significant dimming inside the spaces. But, they definitely have to be commissioned and calibrated. And that's an

important thing.

MR. LEBER: Jeff.

MR. JOHNSON: Yeah, besides echoing that, I think that the commissioning is still going to be an issue, but there are some lighting technologies, particularly the independently addressable ballasts, dimmable ballasts that are coming on line that are going to make the systems more reliable, more configurable, easier to work with than previous systems.

So, much of this study that has been the things in the past I think the studies that have been done in the past cannot be relied on to predict the performance of future technologies. And those are being installed, you know, today in buildings.

MR. LEBER: Don.

MR. FELTS: Just to add to the comment. Commissioning is, of course, important in lighting controls and daylighting controls, but what the lighting research center of PG&E's study found was that out of the eight manufacturers in the United States, seven of them were designing their photosensor lighting control systems so conservatively that their range of operation was

so narrow they really couldn't provide the kind of depth of daylighting controls that you wanted.

The eighth one that did have was fairly effective. Actually it was so costly because the manufacturer built into the cost of the fixture the call-backs that they knew they were going to get to go out there and commission the equipment.

MR. LEBER: Bill.

MR. PENNINGTON: It seems to me that the solution to daylighting controls for side lighting, anyway, is to have a very effective spec that specs what the control would have to do to eliminate the seventh that didn't work and get the eighth one that did.

And my understanding is that there isn't any consensus on a standard spec like that at this point. That's something that LRC wanted to work on and it hasn't happened yet.

MR. LEBER: Did I have a hand up over here? Gregg.

MR. GATES: I'm not sure if it was Jim or Harold who talked about the demand control systems for lighting. I like the idea there are issues regarding sort of system protection if there are transmission constraints throughout the

state, or generation supply problems. If there were true real time pricing -- there could be bill management, I'm using CEC terms here, implications.

And it's sort of a procedural question, I think for Bill. If this would get integrated in terms of the cost effectiveness analysis would you need to assume some kind of a real time price signal or tariff that one would respond to, number one? And, would it be part of this proceeding to figure out if there was 100 or 200 or 500 megawatts of load that could potentially be dispatched or knocked off line to prevent a rotating outage, is it part of this procedure to figure out who might control that? Whether it's the ISO or a UDC or the CEC or stuff like that?

MR. PENNINGTON: So, I probably missed a lot of background here, --

MR. GATES: Oh, you may not have been in the room when we were -- boy, did I set you up.

(Laughter.)

MR. GATES: Well, Jon, can you maybe answer that --

MR. PENNINGTON: I'd like to try to respond, and bear with me that I don't have the

background that I should.

I don't see how this fits into a performance standard, first off. I don't see how that works. Seems like if there was going to be a requirement it would be a mandatory requirement that would be, you know, a thermostat would have to have the capability to do x. And that would have to be demonstrated to be cost effective.

It seems like a significant issue related to that is what's going to drive the use of that thermostat once you have it into the building, or a meter if you're talking about a meter.

MR. GATES: I'm talking about lighting controls.

MR. PENNINGTON: Okay, so maybe you need to clarify a little bit for me.

MR. LEBER: Well, actually I think the answer to this question is really a very long one that has a lot of work for us to do before we can even come close to answering it. About how we're going to deal with the TDV and how we're going to deal with controls issues that might be related to that, and related to potential controls from driven by either utilities or some sort of utility

based signal.

And I don't think we know enough about where we might go with that to be able to really answer that question at this point in time.

Let's see, I did have -- there was another question out. Did I suddenly scare everybody off? Doug.

MR. MAHONE: This is just two quick ones. One is I wanted to announce a study that's just getting underway now. It's being funded through public benefits monies. The funding is coming through Edison for a consultant study.

It's basically a lighting log or study on how people use manual bilevel switching in both daylit and non daylit areas.

And included in the study is a study of how people use manual switching for task lighting in office systems that have permanently mounted task systems -- task lighting.

The results of this study should be available by the end of February. The intent is to get that information into this process, answering some of the questions that people have raised about whether these controls get used, and whether the janitors are doing all the controlling

or what.

So that's just a study that's getting started; that's being managed in my office.

The other point I wanted to make, Jim, is about the tailored method for retail. In your comments about it you've mainly pointed to the difficulties of all the calculations that lighting designers are presented with under the tailored method.

But actually a lot of the feedback I get from the field is that it's a big loophole. That a lighting designer working in a retail space can use the tailored method to basically do anything they want to.

And so I would urge that in revisiting the tailored method for retail that you look pretty carefully at how it can be used or abused so as to, you know, prevent that kind of practice from going on.

MR. BENYA: Well, I'd like to respond to that. I, you know, have been on both sides of that debate over the years. Going back to 1987 when it was first introduced at that time I was engaged by the California Retailers Association to essentially take on the new standard that was

about to be implemented.

And there is a major give-and-take between the needs of retail lighting and the energy code that we're trying to make sure is fair to everyone.

The biggest problem I think we have right now is the excesses of retail lighting in New York and Chicago and other major cities are phenomenal. And none of the projects even comes close to addressing our standard, or for that matter, ASHRAE-IES 90.1, 89, much less 99. That's just the way things are there in the retail world.

So I have some concerns about us being too aggressive and creating a standard where we once again find ourselves being subject to, you know, some real anger from retailers trying to develop properties in California.

It's not a loophole, Doug, and it never really was a loophole. If you follow the standard as it is written, and you do exactly what it says it does, it is more generous than the watts per square foot given int he area category whole building method by a whole lot.

You can justify five or six watts per square foot, which in those cases you probably

need in order to design retail to meet modern retail standards.

The biggest challenge I think we face in going through what the values should be, themselves, is going to be caused by the ceramic metal halide lamp. Does it stand up to cost justification. If it does, it will warrant lower LPD levels.

But in a recent study we did for one client it's pretty iffy. It's in the ten-year payback area which is outside of what we would consider to be probably, you know, code level stuff.

I'm also -- but I do believe that because you do the same calculation every time, that if we were to set up a logical set of standards that somebody could say, okay, I've got a department store of so many square feet and so much of a ceiling height, how many watts do I get.

So create a set of models based on the standard we have today with the values adjusted for technology, I personally believe we could come up with a set of values that people could say, okay, there's my value and simply use it.

The way you do it right now I have yet

to see a store that doesn't have ten percent of its floor space occupied by floor displays. So why do we have to go through that exercise.

I have yet to see a building that doesn't use every square inch of wall that it has in some sort of display. So why do we go through that exercise.

MR. LEBER: I'd like to move on to some other questions here. Jon.

MR. McHUGH: Jon McHugh, Heschong Mahone Group. This summer one of the projects we had to help deal with the demand crisis was to look at recommissioning of photo control systems in top lit buildings. And the reason that we specifically chose that is because it's the easier problem.

Side lighting is a lot harder problem and as a result we basically started rustling the bushes, so to speak, to find people who have top lighting systems and who had photo controls.

The vast majority of those photo control systems actually worked. And that may be that the ones that didn't work actually got torn out. But the ones that are in place are working. and the ones that we found that were broken were actually

some fairly simple design errors that from our perspective, having interviewed over 70 practitioners in the field, was that even people who feel that they are experts in this field, typically only have a handful of projects under their belt.

The energy standards have the opportunity to do to photo controls what they did to occupancy sensors. There were lots of problems with occupancy sensors when they were first released on the market. And, you know, occasionally we still have novices who are positioning those things in the wrong places. So we still have some of the same issues that ideally an intelligent way of specifying this in the standards will help.

The other thing I'd like to bring up is that the vast majority of building stock in the state is single story. And there's a vast amount of light energy that is unused currently. And I think that Jerry Blomberg has brought up an important issue relative to setting top lighting as the basecase for these large buildings.

And perhaps what we should do is start looking at an incremental approach that looks at

warehouses and perhaps big box retail or something like that, pick a subsection of the building stock where top lighting is clearly cost effective, and actually incorporate that into the standards.

Thank you.

MR. LEBER: Other comments? Harold.

MR. JEPSEN: Maybe this will start a whole other bunch of discussions but I failed to mention one measure that we had submitted, and that is in regards to task lighting controls.

And that oftentimes I think we're seeing a lot more task lighting out there. I don't have a study on that, but we would submit that that should also fall under the shutoff control requirements, as well as task lighting in spaces.

And I know we've done a lot of work to get the watts per square foot down to a very small level, yet inside the spaces, and this is outside the realm of lighting, but we've got a lot of other loads inside those spaces that are plugged in that don't need to be on when people are gone. Space heaters and the little clip-on oscillating fans and radios and a lot of other things.

And that the Commission ought to take a look at some of the savings that might be achieved

by controlling those plug loads.

MR. LEBER: Other comments? Nehemiah.

MR. STONE: A clarification. Gregg asked two questions which Bill started to respond to. The first one --

MR. PENNINGTON: I believe the first one, so there was another one --

(Laughter.)

MR. STONE: You responded to the first one. I'm wondering if your answer actually was meant to respond to both of them. Are you saying as far as figuring out whether in this proceeding that the rules of how that gets controlled will be addressed, is too soon to figure out, also? Or do we know that this is not the proceeding in which the rules for controlling light, you know, shedding lighting remotely is not going to be addressed?

MR. LEBER: I think the issue of controlling things is something that we certainly are going to think about addressing in this proceeding. But that we, you know, we don't know enough at this point to know whether we can, what problems we're going to trip over as we start trying to get into that arena, or what mechanisms

might be possible.

And so I think it's one item that's on the table, but, you know, it's on the table with a whole lot of other items.

Harold.

MR. JEPSEN: To that point about the load shedding of general lighting, and I don't think it's so much -- I mean I agree that I think it's impossible for us, at this point, to really determine who should be doing that control, but just as the provisions for bilevel lighting have been in the standards for a long time, it certainly became a good tool for us to use when we got into a crisis.

And I would submit that the recommendation for providing a simple way to go to half lighting, or a general lighting inside of a facility, is maybe a provision just like we did with the display lighting for retail stores, that would provide that provision so there's an easy way to do it if you need it in a demand situation.

And not that we have to concentrate on how it gets, you know, who is going to initiate that, but that we allow the possibility of us being able to do it rather simply as opposed to

someone running around and turning off bilevel switches throughout a facility.

MR. LEBER: Other comments? Questions? Are we ready to move on to the next subject? The next subject is other.

And that's PG&E, I assume that's you, Doug.

MR. MAHONE: Yeah, anybody here from Davis Energy Group? No. Okay.

(Off-the-record discussion.)

MR. MAHONE: Okay. One of the other topics that we're doing under the PG&E case initiatives is modular classrooms.

There are, as anybody who's ever put a kid through California public schools in recent years knows, almost every campus in the state has modular classrooms. And in areas that are growing rapidly there are entire schools that are made up of modular classrooms.

And the energy efficiency of these buildings has not been well regulated. They tend to be manufactured by a small number of companies. They tend to be specified on sort of an emergency basis, the most important criteria is can they get them delivered and plugged in on the site quickly

enough before the school year starts.

So there's a big opportunity here for improving the energy efficiency of these classrooms. PG&E and Edison and others have done pilot programs to demonstrate that substantial energy savings can be achieved through insulation, through cool roofs, through radiant barriers, through the windows, through the efficiency of the lighting and even through skylighting.

Next slide, please. So this graph illustrates the magnitude of the savings that can be achieved. It's in excess of 40 percent of energy savings through a combination of fairly simple and very cost effective measures that can be put into these schools.

Gregg, I see you're about to leave. Do you want to add anything to that?

MR. ANDER: I want to hear what you're saying. We've done a lot of work in this area. Sorry.

MR. MAHONE: Okay. Next slide, please. Another area that we're going to be looking into is what to do about existing buildings, and can we start to capture the energy efficiency potentials through energy efficiency improvements to existing

buildings.

There was a good deal of discussion on this topic yesterday, and we're doing a similar effort on the residential side. So I won't say a lot more about it here.

But there's two scenarios, one is probably the more likely scenario which is minimum requirements for the efficiency of items at the time that they're replaced.

We effectively have that with the HVAC units that are subject to the appliance standards, because if an old HVAC rooftop unit, for example, goes out, you simply can't buy an inefficient replacement for it.

But we could have similar kinds of requirements when roofing is replaced, could require a cool roof or additional roofing insulation, for example. When duct work is replaced we could require that it be replaced with insulated duct work. And so forth.

So we're going to be looking at the whole range of options here and make recommendations as to what we think is feasible at this point to introduce into the Title 24 standards.

Another option that we'll be looking at, but which is possibly a little less likely, is mandatory improvements to the efficiency of the building at the time of sale.

So I guess that's all I'll say about that question at this point.

MR. LEBER: Thank you, Doug. Steve, are you speaking for Edison here? Is that Carlos? Okay. Carlos.

MR. HAIAD: Carlos Haiad, Southern California Edison Company. We believe that the time has come to address the issue with refrigeration in supermarket, food stores. There is an issue; it is part of this body to regulate cold storage as indicated; mostly because they are very high energy users.

I suppose only restaurants would be -- the opportunities are very large, as you can see by the numbers.

Most important, apart from having, you know, already tools that could help us analyze this, there is a major effort that has to be started sometime.

And Edison has already done some work on this area. PG&E is interested is participating in

this work. So I think that is really a good opportunity to start the work, put things in motion.

Quite frankly, I'm not even sure if by 2005 we would have all this done, but we have to start somewhere.

That's all I have.

MR. LEBER: Okay, thank you, Carlos. Questions and comments. Mr. Ware.

MR. WARE: That's everyone that's gone, so far?

MR. LEBER: Pardon?

MR. WARE: Okay.

MR. LEBER: This is for the other category.

MR. WARE: The other?

MR. LEBER: Yeah, the other category; well, it's labeled other on the --

MR. WARE: Okay, yeah, right.

MR. LEBER: Right.

MR. WARE: First of all, comment to Doug on alterations. There are southern California jurisdictions that under their green building policies do exactly what you are suggesting, and have both at point of sale and whenever there is a

permit pulled for a change or an alteration in a commercial building.

They require, again under the green building guise, that that measure being installed or whatever, be actually brought up higher than Title 24 requirements. So there's some precedent for that approach.

MR. MAHONE: Do you know what any of those jurisdictions are?

MR. WARE: The City of Santa Monica has one; and I want to say the City or County of L.A., but I may be -- it may be actually a different jurisdiction. But I thought it was actually L.A. as well.

And a comment to Carlos. We actually are very active in the cold storage arena, and you are exactly right on target. One, there's a lot of energy savings to be gained in that area. And, two, it's a little different ballgame because not only are you looking at the kind of insulation, not just R value, but the type of insulation that is appropriate for various types of cold storage applications. And we would be more than willing to participate and share our work in that effort.

MR. LEBER: Carlos.

MR. HAIAD: Yes. First of all I would appreciate -- I had the discussions earlier with Doug, and one of the concerns about cold storage, which is for Jon and Bill, is it's within the umbrella of this body. It's here to process, you know. In a supermarket, you know, that is building, is interacting with the -- that its impact on people.

So, but cold storage is a process, so I strongly believe that the opportunities are huge for energy savings. It's unclear indeed this board can address that or not, the policy issue more than anything.

But the opportunities are tremendous. And, again, I'm not saying today; let's say that let's look at the supermarket as an office building, it can only use so much energy.

But we start with the individual components, and you know, from display cases to refrigeration systems and racks of refrigeration systems.

As I mentioned before, even on our template we do have the tools to do that analysis. Plus we are doing a fair amount of experimental work, testing various components to achieve, to

understand the potential for savings. You know, are they down here and we can bring them up here. Or they are already up in there. There is huge opportunities for savings.

So, you know, it's never been addressed, and I think it's time to address that.

MR. LEBER: Okay, thank you. Other comments? David.

DR. GOLDSTEIN: This is a comment in response to Doug's presentation on what you can do with existing buildings. It's not a developed idea. But, seems to me we should look at the concept at point of sale of requiring some kind of a calculation of energy consumption, something like the performance calculation as just a piece of information.

Why is that valuable. And if we could do that, this works with another project that some people in the room know about to try to get energy cost estimates incorporated into the appraisal system. And if that ever happens then the owner is going to do all the retrofits in the world just to raise its property value.

The key step is getting the calculation done. Right now there isn't a methodology for

doing it, but whatever it is it would have to parallel the performance calculations pretty closely. So if the Commission simply developed that, you know, maybe there's some thoughts about how could you require it, and should you require it on new buildings and all that that I haven't really thought out.

But I think it's something that's a small incremental workload on what you're already doing with it; might be able to help out --

MR. LEBER: Thanks, David. We're sure it's a small workload.

(Laughter.)

DR. GOLDSTEIN: The emphasis on small.

(Parties speaking simultaneously.)

(Laughter.)

MR. LEBER: Other questions, comments? Are we ready to move to the next subject area? Or, Harold.

MR. JEPSEN: I would say just one other point to the alterations in existing buildings is just, you know, we know the commissioning is core, we've learned today some staggering statistics about controls not working properly. And even just the building tuneup, you know, as opposed to

replacement of systems or things like that; to just address somebody to look at for energy efficiency as just a tuneup of it, might benefit greatly.

MR. LEBER: Other comments? Carlos.

MR. HAIAD: Harping a little more on this refrigeration. We would not really start from zero. The utilities have incentives, programs. In fact, we have established some type of baseline. I'm not prepared to tell you that it's the best possible, but there is a baseline for which we pay incentives. We have been doing this for some time.

But it's not, you know, a plain sheet of paper that we would start at. We have visited this before.

MR. LEBER: Okay, thank you. Mr. Ware.

MR. WARE: To Doug on the classrooms. I brought this up before. We have, indeed, submitted a code change to the I codes for classroom acoustics. There are synergies between classroom acoustics and R value energy savings, and the kinds of features that go into that. I brought that up to you before, so I want to make sure it's on the record that we would like to work

with you closely on that.

MR. LEBER: Okay, thank you, Dave. Other comments? Ready to move on to combined standards, change ideas? Mr. Eley.

MR. ELEY: Can we have the first slide, please. The Commission has reason to believe that a couple of the climate zone boundaries are maybe mislocated.

The first area is in San Diego County. San Diego County actually has four different climate zones, seven along the coast, and then you move inland a couple miles there's climate zone 10; after that then 14, and then 15.

And climate zone 7 is a very mild climate where air conditioning should not be required. A couple of the compliance consultants have questioned the location of this boundary because in some parts of climate zone 7 homes are going in with air conditioning and the climate's considered hot enough to justify air conditioning.

So what we really need to do is to take a look at that and shift the boundary between climate zones 7 and 10, so that 7 only includes those portions that have the strong marine influence and are not likely to be air

conditioned.

There's a similar problem in the San Jose area. Climate zone 4 is actually quite a long climate zone; it's sort of the -- it's the valley between just over the coastal range. It's kind of the southern counterpart in a way to Napa and Sonoma Valleys to the north.

And the southern tip of that is San Jose -- or excuse me, the northern tip of that is San Jose. And San Jose has typically not had air conditioned homes, but just south of there there's a lot of construction activity in Morgan Hill and Gilroy. And those homes are typically going in with air conditioning. So there's some question here about where that boundary ought to be, as well.

These are both important to the state because there's quite a bit of construction activity, both south of San Jose and also in the San Diego area.

The other thing that's -- and I don't have a slide of this -- is photovoltaics. Photovoltaics are now, they're renewable energy. And the standard allows consideration for them. The problem is there's no calculation methods in

either the residential or the nonresidential ACM manuals so that compliance authors can get credit for them.

So this code change would develop some calculation methods for photovoltaics; perhaps put some restrictions on the amount of credit that could be offered. And basically set up the rules for accounting for PVs in the same way we do with all other measures in the standard.

So that's it for those two.

MR. PENNINGTON: Thank you, Charles. SCE, is that you, Carlos?

MR. HAIAD: Yes. Carlos Haiad, Southern California Edison. This idea, the web based communicating thermostat came about because even though the code currently requires setback, our work with retailers, food service customers has shown that they are running 24.

Yeah, he has a setback; yes, they set the heating and cooling but the setback never seems to really appear. And that's absolutely true on small commercial, and to some extent residences, although in homes they tend to actually turn them off. So I don't know.

But, the overall idea is that you can

communicate remotely with a thermostat through whatever means, paging technology, RF technology, broadband technology. This is not, you know, there is a variety of technologies that you can get to that thermostat and these all remotely wireless. It's not that you have to hook up a phone line to the thermostat.

The overall idea is to require the communicating thermostat to be part of the code for anything greater than 2.5 tons, single zone package units. And I think in the residence central air.

It does not address who and how is doing the communication. Just as was mentioned before, the capability is there.

Yes, there's some energy savings, clearly there is demand savings or opportunities. Clearly if you manage that, or somebody manage the energy savings, therefore there is utility savings of costs.

So the brief idea is have the capability with either device, and let the market decide how that capability will be used. All the other, you know, requirements for the thermostat stays, it's just the web communication capabilities. That's

the basic idea.

MR. LEBER: Thank you, Carlos. Geothermal Heat Pump Consortium.

MR. HAIAD: I have another one in there before that.

MR. LEBER: Oh, you have, oh, I'm sorry. I missed that.

MR. HAIAD: The under voltage relay is a little more complex, you know, but the basic idea again is if you have a sag on the voltage, the air conditioning will, you know, try to run hard but it's not going to do anything for you. Voltage drop, the amperage may go up, but you don't deliver anything.

It is clearly more a systems perfection than anything else. The savings of energy will occur on that period where the air conditioning is trying to deliver something but the voltage is too low, so that is a component of energy savings.

I'm definitely not prepared at this point to tell you if it is 1 percent, or 10 percent, or 50 percent. There is a little more analysis that will be required before I can produce those numbers.

But is a simple addition to the unit

that when you get the voltage to drop, to cut out the unit from the system. You can't let the unit come back all at once, so that is to have some, to make built into the -- the A/C unit.

Some manufacturers do have this for larger units, as an option.

That's all.

MR. LEBER: Thank you, Carlos. Geothermal Heat Pump Consortium.

MR. HOELLWARTH: I'm Craig Hoellwarth, Principal of Green, INQ. I'm here today representing the Geothermal Heat Pump Consortium. For those of you who don't know, the Consortium is composed of manufacturers from the industry, from utility companies, code agencies, and supported by the Environmental Protection Agency and the Department of Energy.

We're here today to discuss including geothermal heat pumps, or as we call them, geo exchange systems, in the standards in their own right.

With me today, before I get into this, I have Karl Fisher and Dr. Carl Hiller, who are experts in this field. So if we get into technical questions we have all the expertise we

need.

In terms of -- maybe I can take a little quick show of hands. Does everybody understand what a geothermal system is and how it is composed and how it works?

Okay, you do. I take that you do --

MR. MAHONE: Doesn't work just on the sides of volcanoes?

(Laughter.)

MR. HOELLWARTH: That's right, or deep hot rocks or anything of that kind, any geysers. It has nothing to do with that.

And it is applicable in every area of California or the United States for that matter. It works in high rise buildings as well as low rise buildings. It's jut not a residential technology.

And it has a variety of applications, all of which that work very well. The Department of Energy and EPA consider it the most efficient heating and cooling technology available to us today.

And a related factor, and ASHRAE has supported both these statements, maintenance costs for these systems are the lowest of any heating

and cooling system available to you today by quite a factor.

So even though it's not an energy related savings, it definitely works well for schools and other low income type groups that need to save money operating heating and cooling systems.

Now, with that out of the way, because it is one of the most efficient systems, and it does save peak power, we've indicated here studies show that it saves from .5 to 1.2 kilowatts per ton over conventional heating and cooling systems. So it definitely has a contribution to make as far as peak energy savings.

These savings are persistent, as well. Studies also show that when you select EER 15 system on the cooling side, in ten years it will be an EER 10 system. This is not always the case, and recent studies have shown that air side and other related systems tend to degrade over time. So they will be there for you throughout the duration of their life. And their life is somewhere around 20 to 25 years, not the typical 10 to 15 that you would find in other equipment; thus savings in maintenance there, too.

With this in mind, we've found that in almost every case when these systems are compared on a life cycle cost basis, they will win every time. So they have a long-term value to them that is not always identified, either in the design community or in the standards community, as well.

These systems, because they are earth coupled, and much of what I've heard today and probably would have heard yesterday, relates to HVAC systems that relate to air side heating and cooling, and maybe some water side. There's nothing in the standards that relates really to earth coupled heating and cooling systems.

A related topic yesterday had to do with EERs and the problem comparing those with SEERs. Well, these systems have no season, and they don't operate on those same temperatures that air side systems do when you're looking at outdoor temperature ratings and at ARI.

We also want to identify a problem with evaluation techniques. The techniques in the standards do not accurately model, simulate or evaluate these systems when compared to other systems.

Although they can be modeled to show

compliance with the standards, if a designer is trying to show that he exceeds let's say a PG&E savings by design program, and wants to apply for an incentive, there's going to be an inaccurate comparison. He will not be able to show the benefits that he should be able to show with these systems.

So on both accounts we feel that the standards should identify a specific section within the standards that deal with earth coupled heating and cooling systems. And also that the evaluation techniques are revised to be accurate if these systems are going to be employed, and the benefits are going to be utilized in the buildings here in California.

So, with that, I will -- well, I should say, too, that for that reason that Title 24 right now is definitely a barrier for these systems to grow in terms of market share in California.

MR. LEBER: Thank you, Craig. I believe that completes everything for this item. Questions and comments? Nehemiah.

MR. STONE: Yeah, can we put the lights back up so I can see?

MR. PENNINGTON: Are you hot now, or

cold? Never mind, go ahead.

(Laughter.)

MR. STONE: This is on the first issue, and Charles and I have had some of this discussion offline. I just want to put back on the record again that whether somebody installs air conditioning or not is not a good criteria for figuring out whether you've got the right climate zone.

Air conditioning is not just a comfort issue. It's -- many times it's a socioeconomic issue, and a lot of times you cannot sell houses in a subdivision if they don't have air conditioning, even if they're on the Oregon coast.

People have this perception if it doesn't have an air conditioner it's low income housing and they won't buy it. So, let's not use that as the criteria.

The second thing I want to say on that is, and again Charles and I had this conversation offline, there were a number of things that were done on setting the climate zone boundaries back in the '89, '90, '91 project. And establishing what were valid weather stations and figuring out where the boundaries based on those.

I would highly recommend that all the people that were involved in that, you know, get involved in reviewing what it is that's going to happen on this time around. Because it was a pretty sophisticated way of figuring out where the boundaries ought to be.

We also used a very sophisticated method for establishing the weather tapes, not appropriate to what they're being used for today, but it was a sophisticated methodology anyway.

So, I just would recommend, you know, revisit that by bringing the people that were involved in it back into the process.

MR. PENNINGTON: Are you saying that you think the current climate zones in these areas are correctly placed?

MR. STONE: Let me tell you why I think they very well may be. I mean we had -- Dick Palmer raised the issue of climate zone 10 being wrong back then, and we took a look at every single climate zone. And we found 480 some odd weather stations in the state that we thought, you know, were reasonable. And it got narrowed down to a whole lot of smaller number than that.

But then we looked at every station on,

you know, five or six data points relative to the weather tape for that climate zone. And there was nothing, there was not a single one down in the area of 7 or 10 that was out of place.

Now, it could be that there are no stations right near that boundary, I don't know. I don't remember. But, that report examined -- and, you know, it was plotted out, again, over six or seven different data points. How does this relate to climate zone, you know, how does this station relate to climate zone 7, relate to 10, 14, everything.

And those that were within, you know, that were closest to the weather tape for that climate zone stayed there. No changes happened around 7 or 10. Other than, you know, we changed 7 to include Pendleton instead of cutting through the middle of Pendleton. But that was the only big change there.

So it's quite possible that, I mean there's a misunderstanding about what the climate zones are. As you move from the coast over to, you know, Arizona, you're going to go through these changes. And you've got to make some arbitrary decision, okay, well, here's where the

line is.

And, of course, standing on one side of the line versus the other side of the line you're going to have less difference than standing on one edge of that climate zone versus going over to the other edge.

And so you can say well, this place is a whole lot more like that place across the street than it is like that place over there on the coast. Yeah. But you've got to draw your lines somewhere. And, you know, you can't just have this kind of moving gray boundary that goes from one place to another.

MR. LEBER: Other comments? Jerry was kind of up here already, so.

MR. BLOMBERG: What I would like to see, if we were going to mess with the climate zones, is to include a section for daylighting. Because the temperatures don't necessarily reflect the availability of daylighting. And it might be useful to do that, if we had the resources just to kind of identify daylighting areas.

MR. STONE: Cloud cover was included, but only inasmuch as how it affected temperatures.

MR. LEBER: Okay, thank you. Craig.

MR. HOELLWARTH: Along the same lines as I indicated before, we have a climate zone map. And as far as I know there are no maps for ground temperature, ground water temperatures if we're going to implement geothermal heat pumps. And I'd suggest that if we are serious about using these efficient systems that we include these kinds of criteria in the mapping system.

I assume that the maps are used for energy analysis and for demonstrating compliance with the standards. So I would suggest that we include ground source criteria, as well.

MR. ELEY: Well, the climate's, Craig, have ground temperatures, but you're talking about ground temperatures a couple hundred feet below the surface, so that's a whole different thing.

MR. HOELLWARTH: Well, they're readily available. This data is available throughout the state. And we're talking about temperatures really that are only down from six to 12 feet below the surface in terms of the design temperatures that are used for these systems.

Once you get below those depths the temperature stays the same pretty much year round 100 percent of the time.

MR. LEBER: Carl.

DR. HILLER: Carl Hiller with Applied Energy Technology. I was formerly with Electric Power Research Institute and we were the ones who funded most of the research that went into bringing the geothermal heat pump industry to where it is now.

I'd just like to add my comments to what has been said about geothermal, and urge the state move forward.

As Bill and Jon know, I recently completed some work for the State of California that is a step in the right direction of changing the analysis procedure such that geothermal can be compared properly.

The missing link now would appear to be how to account for the ground temperature in a ground heat exchanger. And I urge the state to move forward to that next step. And I think there's some simple quick and dirty things that we can do in the short term to at least get something in there. And then we can improve on that later. And I won't take everybody's time now to outline those, but if anybody wants to know I'm available to comment more on that.

MR. LEBER: Dave had a comment.

MR. WARE: First of all, Ken Nittler left, so I'm going to put on Ken's hat in regards to the climate zone --

MR. LEBER: Well, --

MR. PENNINGTON: Which one?

(Parties speaking simultaneously.)

MR. WARE: As a software vendor and observer of the compliance process; Nehemiah raised the same concern in possibly consideration of moving some of the climate zones.

The use of air conditioners should not necessarily be an indicator that there's a problem. And Ken's point was, and I think well taken to me, in that the differences between climate zone 7 and 10 and 3 and 4 are really a difference in the amount of tradeoffs that are available.

So if you move an area boundary into a zone that has a higher budget, then tradeoffs and measures that are used make a larger impact. In a climate, like climate zone 3 or climate zone 7 it's more benign. The kinds of measures that you use have less of an impact.

And so Ken's point of view was that you

need to be very careful because actually, correct or not, the point is that you might actually be losing energy savings that you have now in that swing area because of the fact that there would be more opportunity to play compliance games.

The other issue, wearing Owens Corning's hat, and one of those of Ken's, I guess again as a software vendor, --

MR. ELEY: That hat's peak, right?

(Laughter.)

MR. WARE: -- is the issue of PVs that Charles raised. You did indicate, Charles, that there needs to be, or you thought that there should be some restrictions if indeed there was an algorithm or something.

Well, at a minimum Owens Corning and NAIMA feels that there must be some restrictions on that because we want to insure that there's not, you know, there's some restrictions on the amount of tradeoffs and energy degradation to the building envelope or to the building as a whole in regards to photovoltaic systems. That is an issue that I think we indeed feel strongly about.

Now, putting on Ken's hat, Ken feels that you ought to liken this issue to the F chart

or next solar fraction that we do. One, why require and/or spend Commission dollars to develop an algorithm for PVs when there's so many other things on the table, and someone like Ken will have to implement that into his model, or Martyn, if he's still around here, as an example for a technology that isn't knocking at the door.

There is a compliance options process the Commission has for which anyone could utilize if they felt the need to, for PV systems. But no one is doing that.

So, Ken's concern is that if, indeed, the Commission develops, you know, a PV algorithm, he's going to have to implement it; he's going to have to, you know, the vendors, as a whole, are going to have to implement it, do the reporting and all that sort of thing for something that is not going to -- that he's going to have to tag on a cost to his computer program for something that's not going to be used very much.

And so if there's value in developing an algorithm of some sort that deals with compliance aspects of that, applies that, then deal with it offline from the ACM, so that like solar systems, if you use an F chart, you take the net solar

fraction of that. You put it in the water heating compliance process in the ACMS.

So take the PV thing, if that is a route that you want to spend time and energy developing, develop that quasi to a compliance option that is a stand-alone. Get a PV space conditioning fraction of some sort and apply it in the ACMs.

MR. LEBER: Thank you, Dave. Steve.

MR. GATES: A comment to start with, and then a couple questions. In regards to photovoltaics and photovoltaic algorithms, there is a developmental version of DOE2 that has photovoltaic algorithms in it. Perhaps you can list the two separate components, one is the PV array, itself; and the second is the -- that you then hook up multiple arrays to.

The program is capable of simulating multiple systems, oriented different directions. So, for example, if you were to have photovoltaic panels incorporated as part of the building structure, you could actually associate those with the various walls, or roof surface areas, and actually have them oriented properly.

So, that, you know, certainly in terms of the commercial side the program is already

quite capable of simulating the systems, as well as simulating those systems in conjunction with either the existing utility rates that are in place for cell backup PV power. And then in terms of future of time dependent valuation. It's all there ready to be incorporated with whatever else is done with TDV.

Shifting subjects, I have a couple questions on the presentation on the geothermal heat pumps. The slide indicated that geothermal heat pumps could achieve savings as high as 1.2 kW per ton.

That translates to a change in EER or SEER of 10. And I'm curious to know, in terms of, you know, systems approved for use in California, whether you actually expect those types of efficiency gains through geothermal. And if so, how do you do that?

MR. HOELLWARTH: I don't know if I'm the one to talk about how you do that, but the studies were provided by the Geothermal Heat Pump Consortium. And basically in terms of EER, I did have a slide that showed some of the differences.

When you're looking at EER for ground temperatures, of course, it's quite different, and

groundwater, it is than air. And the range of EERs with geothermal is ranging from 10 to 20.

And so there certainly is latitude of a change of 10 there. I don't know if that's going to answer your question or not.

MR. GATES: Now, is that for a system that uses well water directly? Or is that for a --

MR. HOELLWARTH: Just ground, for a closed loop system, as well.

MR. GATES: Okay, because within the last year I had to -- the DOE2 program simulates ground loops. And one of the changes that I was asked to do was to modify this system so that you could use a cooling tower in conjunction with it. Because particularly in commercial buildings it's very common that you saturate the ground. And the systems are then tripping on and tripping off on the high temperature limit, which is on the order of 130 degrees.

So that's actually, you know, two comments there. One is these systems very commonly are rejecting heat well above 100 degrees. And second, particularly in terms of California climates, where the vast majority of

commercial buildings are cooling dominated, and you're pumping far more heat into the ground than you're ever taking out, my impression is that the systems are almost always going to need to have a supplemental cooling tower to reject the surplus heat.

Coupled with that the concept that somehow you designed these two existing ground temperatures is -- I'm puzzled by what that has to do with what happens to the ground after you've been charging it for five or ten years with heat. And, yes, originally you have a ground temperature of 55 or 60, but after five or ten years you have a ground temperature of 100 plus degrees.

So I'm a little puzzled by the relevance of that kind of data in California climate zone maps.

MR. HOELLWARTH: I don't think you'd have that change if you had a balanced heating and cooling situation.

MR. GATES: But you don't.

MR. HOELLWARTH: Yeah, okay.

DR. HILLER: Yeah, I can comment more on that. First of all, you're right in that with some of the earlier geothermal systems, and the

design techniques that were in place say 10, 15 years ago, they hadn't really looked at the long term. They weren't doing simulations when they did the sizing out to 20 years, say.

And as geothermal heat pumps had been in longer they started to see that effect. They've gone back and refined their design procedures now. Typically when they do a design for geothermal system now they actually look at a 20-year time horizon just for that reason.

And especially in a cooling dominated application the ground will heat up, and for example, the older designs used to specify say ten feet on center for vertical bore holes. And you'd have a field of, you know, couple hundred, let's say. And they'd be ten feet apart.

A modern design, those would be 20 feet apart. They wouldn't put them so close together anymore. Because they became aware of that effect; they weren't looking far enough out initially.

So you can design and they do design nowadays for how much temperature rise are you going to accept in the 20th year. So that's issue number one.

Number two, I don't think the statement he made, I think that was a general statement, and really does probably more apply to the heating and cooling, both, rather than just cooling.

But a third comment is when you include water heating, and there's a tremendous capability easily to capture waste heat off a geothermal system, many many of them come with the -- built in. Or you can put a water heat pump, water heater off of a loop. Or you can use one of the modern full condensing water heating systems.

You can't beat that. I mean that is basically free waste heat for the taking. And that, you know, you can go to almost infinite EERs when you start looking at the combined effects of that, especially if you have a large water heating load. There's way more heat available than you could ever use for water heating.

And, you know, a lot of the analyses and certainly the code compliance stuff didn't take that into consideration at all right now. If you do, you really get high EERs.

MR. GATES: Yeah, that's certainly a valid point there. In fact, I understand in Florida just packaged air conditioners oftentimes

will have a de-super-heating circuit in it to use for water heating.

DR. HILLER: Yeah.

MR. GATES: So that's true of all types of compressor systems.

DR. HILLER: Yes. The difference between typical air to air systems, which are usually split systems, is the manufacturers don't install those. It has to be the guy in the field that installs those. Those are kind of retrofit on the system when it's installed, or you can actually go back and cut into the system to install it.

Whereas in geothermal systems, which are sealed systems, in residential let's say probably 80 or 90 percent of all the units shipped out of the factories come with these superheaters in them. Because people are using them because it's so easy to do.

You don't have to retrofit in the field. And so you see more of them.

MR. GATES: Yeah, including if you retrofit them in the field you typically will void the manufacturer's warranty.

DR. HILLER: Yeah.

MR. LEBER: So, do we have other questions?

MR. MAHONE: Yeah, I've got another question about the geothermal. Does your proposal include any kind of a well testing procedure? It seems to me that the ground characteristics have a great deal to do with how well these systems are going to perform. If you've got an area with a high water table and there's a lot of thermal exchange from underground water movement you got a very different situation than if you're in a desert, dry ground kind of situation.

And it's also very climate specific. I was just involved with a school up in Truckee that was putting in a ground source heat pump. And the designers had looked at a map and assumed that the groundwater temperature was going to be 50 degrees.

Well, they dug a test well and turned out it was 40 degrees. And that's got a big effect on the design of the system, and its long-term performance.

DR. HILLER: Yeah, one of the things that's becoming more common practice, especially when you're doing a very large commercial

installation, it's usually very cost effective to do a test bore and see what's down there, and see what the temperatures are. And actually put in a heat exchanger and see what kind of heat transfer you get out of whatever's down there.

And especially in vertical bore systems where you're going to go down usually at least 300 feet, sometimes 1000 feet, depending on your conditions. It may be cheaper to go 1000 and do one hole instead of you know, 300 and three holes, depending on what you're drilling through.

You hit on something there, but there are ways around it that have been developed. First of all, analytically, if you're designing a system up in the high desert where you know you're 1000 feet above the groundwater table, you design your system accordingly. And you make assumptions or you do a test bore and find out what the ground thermal conductivity is there.

Your performance is certainly better in a saturated soil condition. But that doesn't mean you can't design the system for a nonsaturated condition. It's done all the time. You just have to design the system properly.

MR. MAHONE: Yeah, I'm just wondering if

the proposal for Title 24 would include a requirement for that kind of testing? Or would you be able to, with sufficient confidence, just declare assumptions that would be applicable throughout the state? Or how would that be handled?

DR. HILLER: Well, these ar some of the issues that need to be addressed. That's why I said there are some quick and dirty ways of doing it. And then there's more sophisticated stuff.

Right now it's not even in the standard because of the way Title 24 is done, you can't even look at geothermal systems.

And, you know, maybe we should crawl before we walk. Let's get the thing in in some fashion, and then make it better as we go along.

MR. FISHER: Let me just add a little bit. Karl Fisher, LK Fisher and Associates.

A little bit to that ground conductivity as we call it, thermal conductivity of the soil. I actually did the thermal conductivity study for the Truckee Middle School. I do these all the time.

There's readily available software now that is used for, some of them are developed for

residential systems. And what they do is they give you, that software will give you classifications of certain types of soil, rock formations, that type of thing, such as saturated heavy or damp light or this type of thing.

And they're ranges of thermal conductivity values. And these software for residential and small commercial applications have a fairly large safety factor built into them that protect the software maker.

But anyway, on commercial larger ones you do need a thermal conductivity value to plug into the software, to dial in exactly what that loop length is going to be.

And in any of these cases all it boils down to, no matter what the soil is like, it's just a matter of the worse the thermal conductivity is, the more pipe you put in the ground. That compensates for it.

So, it's just a design process that's fairly easy to quantitate.

MR. LEBER: Craig.

MR. HOELLWARTH: One last thought here. It's this very reason that we think that a specific section should be identified for ground

coupled systems in the standards. There's a lot, it covers every facet really that other systems do within the standards. And we'd have to take all day to talk about all the variations and the issues surrounding the design of these systems.

But you can't use any of that information right now in the standards. And that's why we think it should be there in its own specific area of reference.

MR. LEBER: Okay. Don.

MR. FELTS: I have a question in regards to geothermal heat pumps in commercial buildings, in particular schools, which are assembly occupancies and have a high ventilation rate.

Is it necessary to install a separate air handling system to satisfy the ventilation and economizer requirements in those types of buildings?

As I understand it, these are small heat pump units that are scattered about say one for each classroom?

DR. HILLER: Typically the designers of this technology like to use smaller heat pumps to control specific zones which adds to the overall efficiency of the system. It also reduces

maintenance. It also reduces problems of having all or half or a quarter of your facility down if something goes wrong, you lose one little zone.

So, that type of design is beneficial for many many different reasons, including load shedding.

But to answer your question, -- would you restate it again? Now I've got off the track. Oh, the ventilation, I'm sorry, yeah.

MR. FELTS: Especially for high ventilation occupancy such as schools.

DR. HILLER: As schools, yeah. Ventilation is something that I get questions on all the time. And you can approach it in many different ways.

One, you can have the capacity of each zone heat pump that will take care of outside air. You can use energy recovery ventilation, whether it be the heat wheel or heat pipe or any of these type of things which I tend to encourage if it's at all possible to do that.

You can also incorporate water to water geothermal heat pumps, or geo-exchange heat pumps, to produce chilled water or hot water to do a hydronic coil for preheat or prechill for outside

air.

So there's a number of ways to approach it.

MR. FELTS: The reason that I ask this question is I'm wondering about the cost effectiveness of these systems when you have to go to that extent.

I mean that is a big issue here, is the cost effective -- being able to show cost effectiveness.

MR. LEBER: Well, if I may interject at this point. Not that we aren't a little ahead of schedule, however having an hour and a half to talk about this category and not allowing more time on other categories seems a little inappropriate.

In terms of cost effectiveness, unless we're having intentions of basing the prescriptive standards on this particular system type, it's not really that critical, at least in terms of the Commission's needs at this point, to explore the cost effectiveness. That's an issue for the designer. And they don't have to communicate with us at all about that.

Our only issue is about, you know, if

we're going to have something, in terms of a compliance methodology that we have a, you know, fair and accurate way of accounting for things, that we have things that are enforceable.

David.

DR. GOLDSTEIN: One other observation on this. Maybe I'm missing the Title 24 issue here with respect to this particular technology, but it seems to me that if you had something very simple and very conservative as to the benefits of this system, you'd at least let them qualify for installation.

And I mean you don't need a huge tradeoff. If you had a system that saved 30 percent, it's so expensive to install you're not going to make your loads 30 percent bigger to compensate. You get into capital cost trouble.

So, I mean maybe even the simple minded-est thing is if you said this is as good as minimum Title 20 equipment. That at least says all right, you're not getting any credit, but at least we're not a barrier.

MR. LEBER: Well, at this point, if I may respond to that. I believe we're already in that position. That's the current status.

I think the issue that we're facing is that they really want some more credit so that they can have help support the cost of their system, to put it kindly.

Before we go back on this one again I'd kind of like to get an idea, do we have other questions out here about other subject matters that were under this general subject? Ahmed.

DR. AHMED: I have two questions. One question was on the geothermal heat pump, and the other one was on photovoltaics.

MR. LEBER: Go ahead.

DR. AHMED: On geothermal heat pumps, I'm just curious about the savings numbers. If there is really savings how could you say 1.2 kW per ton if it's savings over our conventional system. Because conventional systems use about that kind of energy. So it would be almost like as if the system is using zero kW per ton.

So I did not understand that. Maybe I'm missing something there.

Number two was regarding photovoltaics. I think the Commission's desire to look into photovoltaic systems can be supported, but I think at the same time we need to look at under the TDV

scenario the self generation and distributed generation systems.

I understand last time when we discussed this it was pointed out that, you know, it is not a renewable energy. Of course, we realize that it's not a renewable energy, it's using natural gas.

But, it does offset peak loads and therefore it should be considered as a part of the analysis too, and there is a tremendous impetus right now by four of the California utilities to push the systems with turbines and engines.

And I was at Hess Microgen in Carson City, Nevada, looked at their plant and their products. Basically I got the information from them that a lot of these systems are going in commercial office type buildings, even though they don't promote it. They would rather see them operate 24 hours a day.

There are people who are buying them and actually going into shared savings plans in existing commercial buildings. And with this impetus with the utilities funding a large percentage of these costs, there's a good chance that we will see a growth of this market even in

the new construction market.

And technologies do exist, and IC engines are over 100 years old, I think. So it's not a question of the technology not being available. It's just a matter of providing them or comparing them with the conventional systems, and they should get their due share of credit if they deserve.

MR. LEBER: Mazi, you had a comment?

MR. SHIRAKH: I wanted to respond to some of Dave's comments. I forget which hat, though, I kind of lost track after the third one.

On the photovoltaic, I think the Warren Alquist Act actually requires us to look at the sources of energy that are renewable such s photovoltaics. And we have to regulate anything that comes from nonrenewable sources. That's the difference between PVs and distributed generation.

I agree with Dave and Charles that there should be -- we look at photovoltaics, there should be a limit on the amounts of credit so everything doesn't get traded away, although I don't think that's a big concern because of the cost of photovoltaics. Insulation is a lot cheaper, most contractors in the state, they would

not trade away insulation or other features for photovoltaics at this time.

As far as how widely it's going to be used, we don't know, but it's not uncommon for standards to have incentives for certain technologies that -- incentives for occupancy sensors, for instance, for over a decade. At the beginning they were kind of marginal, but now they've become mainstream to the point were we're talking about taking -- incentives for them, incentives for dimming ballasts, daylighting controls.

And so I don't really see this as being fundamentally different.

MR. LEBER: Nehemiah.

MR. STONE: Yeah, very quickly. A different answer to Dave, and I think, you know, Charles, correct me if I'm wrong, but I think the proposal here for PV is to do exactly what Dave and Ken were talking about, and that is to have a sidebar calculation. Treat it exactly like F chart, in which case, you know, nobody has to put it into their program, it's not required to do that. If Ken wants to put it in there as an additional module and get extra credit, that's

fine.

So, the burden is not being put on Ken to do that.

MR. LEBER: Doug.

MR. MAHONE: I had a question for Carlos about the web based communicating thermostats. I just went through the hassle of getting a DSL line installed in my house so that I've got fairly good web access at this point.

But if I had a web based communicating thermostat, would I have to have a persistent web connection so that it could be dispatched from someplace? And how would that work?

MR. HAIAD: If the technology of communication that you have chosen is broadband, DSL. If you want to be in the office and say, you know, now I am going home, I'm going to bring my house that was at 80 to a cozy 74 just before I leave, yes. The communication have to be open, otherwise you couldn't talk to that box.

Keeping in mind that in that particular scenario, is that you would get to your home through your broadband, but most likely will be powerline carrier that would talk to the thermostat.

We can discuss that. But there is other ways. I can talk to that thermostat through one-way paging. I can talk to that thermostat through two-way paging. I can talk to the thermostat through RF signal, radio frequency. I can talk through 154 megaHertz frequency that Edison owns it.

I mean there is a lot of ways that I can talk wireless with that thermostat.

MR. MAHONE: So do you have a proposal which one of those -- or is that what you're going to do is look at the options?

MR. HAIAD: We are looking at that, you know. As a utility, we have the mandated pilot to deploy 5000 of those things. Apart from that I've been working on this since '99, and I have working with one-way, two-way paging and understanding, you know.

You go in the lab, everything's clean and neat. When it's put out there and somebody's throwing, you know, a hammer at it, how persistent it is.

Let me tell you, food service. They are drooling over this because the manager drop that thermostat to, you know, 70 --

MR. LEBER: How well does it operate after they've done that? No, never mind.

(Laughter.)

MR. HAIAD: But, you know, if you can remotely control that, you know, so you put it at 72, you know, you can send a signal and say no, you know. Or with the seasons, every four months you send it a new setpoint. You know, this is by the thousands at a time.

MR. LEBER: I think we have the idea on the table and probably don't have sufficient time to discuss all the potential ramifications of that.

Do we have other questions? I'm going to go to Dave first.

DR. GOLDSTEIN: I have an observation about prioritization because we've got a lot of good ideas on the table. It seems to me the last couple we've been discussing, photovoltaics, combined heat and power geothermal heat pumps, are areas where these are technologies that are not compliance technologies. These are technologies for going way beyond compliance.

And so in the Title 24 proceeding I would say you won't get any more energy savings

from crediting any of these things because they just trade off against something else.

We ought to find resources from a different pot that can go to how do you calculate the benefits of all these things for incentives purposes.

Because, you know, whether it's a utility program -- a lot of you know I've been working on tax incentives proposals, there are all sorts of different ways. Then that's when you're going to need to know accurately how much does a geothermal heat pump save, because 40 percent is different than 30 percent.

And, you know, how much do you get out of photovoltaics, and how much credit do you want to give for use in a commercial building, and so on.

So, I would kind of encourage that to be placed on lower priority for the Title 24 revision proceeding. But keep your ears open for other ways, the different pots of money and expert people could be devoted to solving the problems, because it's important that we do come up with credible and good answers to these questions.

MR. LEBER: Thank you, David. Carlos.

MR. HAIAD: I have a comment about that, I'm sorry, PV. Yes, studies have charged now DOE2 has some capabilities, but there is, you know, Charles, you and I could talk, it is fairly robust, full blown, Windows based software to do PV analysis. It takes into account, you know, it's 8760, takes into account losses on the line, the connections of the PV against PV, losses everywhere.

So, anyway, I think there is a lot out there already that we could simply, you know, grab it, so to speak, if indeed, you know, we wanted to building something.

MR. LEBER: Ahmed.

DR. AHMED: Yeah, just following up on David's comment. If the Commission -- if the staff is resource strapped, then perhaps these three technologies that David mentioned, PV, DG and geothermal heat pumps, perhaps we could have compliance option methodologies developed for them instead of getting into this 2005 calendar by July. Maybe by December have some compliance option methodologies available.

At least that way the public becomes aware and they do get some credit if the

technologies deserve any credit.

Would you agree, David?

DR. GOLDSTEIN: Yeah, I'm saying it's important that we have a methodology to calculate the savings for market based programs or incentive programs. But that opens up, I think, different potential sponsors and different parties that might be interested in doing something to see them parallel with all the great ideas we've been hearing today that will give us more energy savings out of Title 24.

MR. LEBER: Other comments?

MR. GATES: Yeah, real quickly. If you're going to follow David's advice I'd like to take all of my suggestions and move them into the mandatory measures.

(Laughter.)

MR. PENNINGTON: Too late. Is the lighting okay for you now?

MR. GATES: No tradeoffs, everything's mandatory.

MR. LEBER: I think we're running, starting to run in circles here.

Just a comment about comp ops. One does have to keep in mind, even though you have comp

ops, wonderful things for having compliance options come in. However, if they come in while we have the rulemaking or follow up implementation work of the rulemaking still happening, the internal resources to deal with this don't increase to handle that additional option.

And so things will start to get in the way of each other. And you just have to keep that in mind.

With that, I think, unless somebody has some really burning -- oops, there is a burning -- Carl's burning --

(Laughter.)

DR. HILLER: I just wanted to respond to Dave's comment on geothermal heat pumps. And just make them equal to, you know, your minimum air source system, let's say.

Take the example of a residential application in say Lake Tahoe, where there's a lot of heating load. If you do that why would you ever put one in? Because they cost, what, twice as much at least?

And the fact of the matter is they're at least 30 percent more efficient, and they use a lot less backup resistance heat because they're so

much more efficient.

DR. GOLDSTEIN: Carl, I think you were picking up a metaphor rather than a proposal. What I'm saying is rather than take a year or two and go through all sorts of analytic effort, there is some number of savings about which no one will disagree for even the worst case installation of a ground source heat pump. I don't know what that is. It's certainly zero, maybe it's 10 percent, maybe it's 20 percent, I'm not an expert.

But just pick the worst possible case and say, all right, immediately we'll all agree that you get at least that. You get more most of the time, and we don't know how to calculate that.

So, I'm just saying an incremental step kind of procedure. The fact is my dream would be that we get the federal government to pass this tax incentives bill and then DOE is on the hook to fund the methodologies that come up with the real answers. And that's a new set of resources to do it.

DR. HILLER: Okay, well, then we agree. We're both in favor of doing something quick and dirty to get it into the standard in a way that at least makes some sense in the short term.

MR. LEBER: Okay, I would like to thank everyone for coming. We appreciate your input.

And we talked about the next steps yesterday. You can read those in the transcript when it becomes available.

(Laughter.)

MR. LEBER: I don't want Bill to find out what I said yesterday for at least a week.

(Parties speaking simultaneously.)

MR. LEBER: Thank you, again. We are adjourned.

(Whereupon, at 4:00 p.m., the workshop was concluded.)

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CERTIFICATE OF REPORTER

I, JAMES A. RAMOS, an Electronic Reporter, do hereby certify that I am a disinterested person herein; that I recorded the foregoing California Energy Commission Workshop; that it was thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney for any of the parties to said workshop, nor in any way interested in outcome of said workshop.

IN WITNESS WHEREOF, I have hereunto set my hand this 25th day of November, 2001.

JAMES A. RAMOS